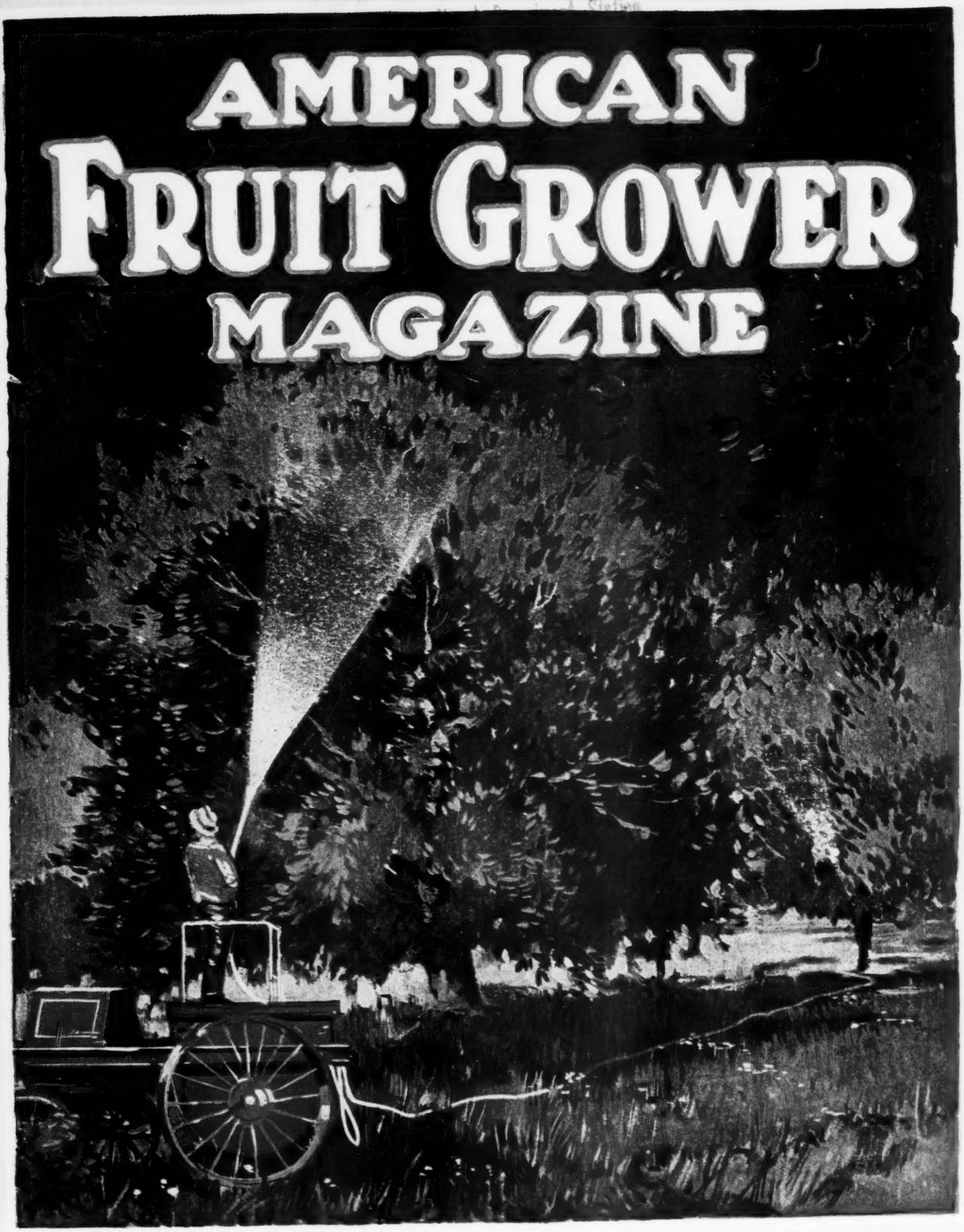
AMERICAN FRUIT GROWER MAGAZINE



February, 1928
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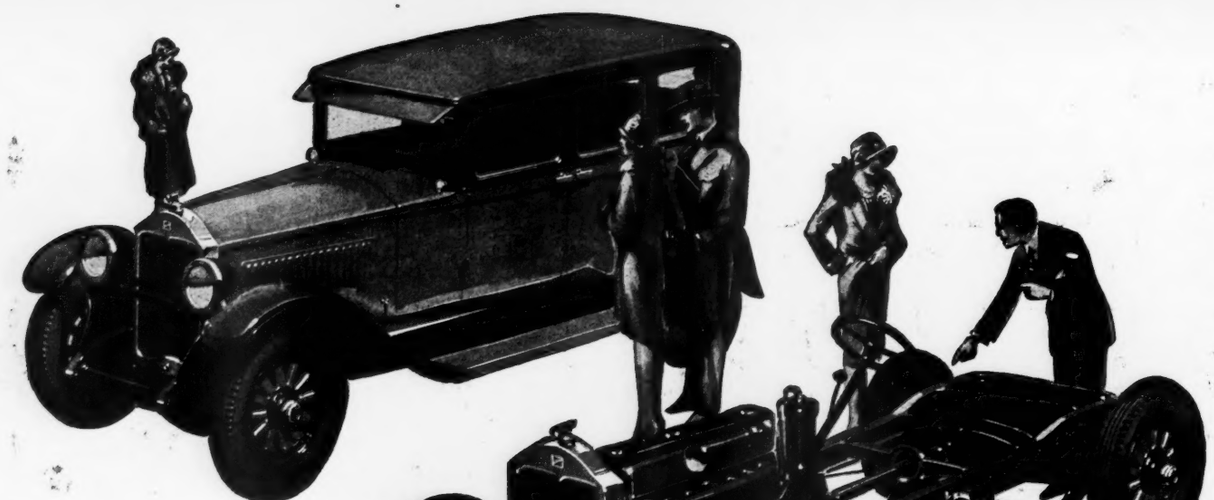

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Spreaders and Codling Moth Control

By Ralph H. Smith

University of California

THE CODLING MOTH is generally regarded as a native insect of southeastern Europe. It probably was introduced into North America in early colonial times, soon after the first apple trees came into bearing; at least, wormy apples were a serious problem in the New England states in 1819, when the discovery first was made that the worm infesting the apple changed to a moth and that the moth was none other than the codling moth known two or three centuries previously as an apple pest in Europe. In the early period, the chief method of control consisted of picking the wormy apples from the trees and destroying those falling to the ground.

It was about the year 1840 that someone made the discovery, that "if any old cloth is wound around or hung in the crotches of the trees, the apple worms will conceal themselves therein," whence they can be destroyed; and during the succeeding 50 years banding was one of the leading practices in control.

Progress in Spraying

In the spring of 1878 E. P. Haynes, living in western New York, sprayed some apple trees with Paris green, to destroy the spring canker worm that was feeding on the leaves. It was discovered in the autumn of that year that the apples on the sprayed trees were not as wormy as those on the unsprayed trees. This discovery soon came to the attention of entomologists, and, during the next 10 or 12 years, many spraying experiments were performed throughout the United States. Although the experiments were by no means uniformly successful in controlling the worms, the conclusion gained predominance that, if the spraying were properly done, practically perfect protection of the fruit could be secured.

The period from 1890 to 1910 largely witnessed the change from Paris green to arsenate of lead as the favorite spray material. Power sprayers came into quite general use. A period of exhaustive life history studies began in 1900. The dominant trend of investigation and discussion centered around the "one-spray method" of control, or control by the calyx spray only.

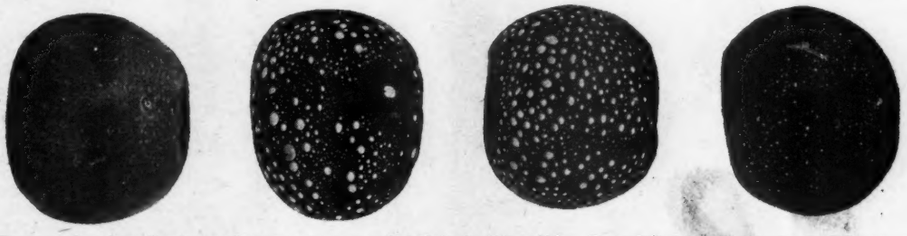
The period from 1910 to 1920 brought forth important improvements in the physical and chemical properties of arsenate of lead. Large capacity, high pressure sprayers and the spray gun came into general use, particularly in the specialized fruit districts in the western states. The one-spray method of control was abandoned, and the important value of the cover sprays came to be fully acknowledged. Extensive life history studies were continued in all important apple and pear growing districts.

The present period began with 1920 when spray spreaders first were recommended and when the question of excessive arsenical residue stirred the apple and pear industry of the western states. A near crisis regarding spray residue has been overcome, tentatively at least, by the use of washing and wiping machinery. Important research relating to moth baits has been carried on. Renewed interest in banding as a means of control has been manifest generally, and various experiments along new lines have been started. The possibility of control by the artificial propagation of an egg parasite has been a matter of investigation. Oil sprays have been quite extensively tested experimentally. Many experiments on spraying with arsenate of lead have been performed. The efficacy of arsenate of lead spray has been subjected to critical investigation both in the orchard and the laboratory, with the result that certain conceptions long accepted as firmly established must be modified or rejected as erroneous. The last of these subjects will be discussed in this article.

Background for Spreaders

The late Prof. A. L. Lovett of the Oregon Agricultural College deserves the credit for instigating a new line of endeavor in codling moth research. He was impressed by the fact that there was a wide discrepancy between the perfect control which spraying was supposed to be capable of giving and the relatively poor control often obtained in carefully sprayed orchards. This discrepancy, he believed, could not be accounted for entirely on the ground that the sprays were not applied at the proper time or that they were not thoroughly applied. One possible explanation was that some worms entered between the spots of arsenate of lead, and this, among other things, led him to investigate spray spreaders. His investigations on spreaders were briefly reported in this magazine in February, 1923. It has been my privilege, as a former student and co-worker of Prof. Lovett, to continue with this general line of research.

Curiously as it may seem, no one apparently ever definitely ascertained to what extent, if any, worms were able to enter between the spots of spray. It merely was assumed that wormy apples were the result of worms entering before the spray was applied or entering at places not actually covered by the arsenate of lead. The belief was accepted almost universally that in order to minimize the chances of worms entering between the spots, the spray should be applied in such a manner as to cover the fruit with innumerable mist-like particles; it being supposed that the resultant fine deposits of residue would be so fine deposits of residue would be so close together that the worms could not get in between them. The desire to accomplish this type of coverage was a very important reason for the development of the high pressure sprayers. Notwithstanding the use of such sprayers, however, it was physically impossible to give all of the apples the fine spotted covering. In order to reach all parts of the (*Continued on page 37*)



These apples show the types of spray coverages referred to in this article. From left to right are shown film coverage, overspray coverage, coarse spotted coverage and fine spotted coverage. The fine spotted coverage proved the least effective against worm injury. It is advisable to apply the spray as a fine mist under high pressure, but a sufficient quantity should be applied to coat the fruit with large drops or with a film in case a spreader is used

EDITORIAL CONTENTS

DEPARTMENTS

The Japanee Beetle Is Spreading

By Amos Kirby

THE JAPANESE BEETLE is headed for the southland. Fourteen months ago it had crossed the Mason and Dixon line. Last winter it had reached Baltimore; early the past summer it had passed Washington, and by now it probably has gone into winter quarters on the edge of the cotton belt.

Just as various members of the family of this restless pest have tramped over the Orient from Siberia to Java, so apparently it is planning to romp over all the American continent. It is only a matter of 11 years since the Japanese beetle was first found near Riverton, N. J. At that time, it had spread over a half of a square mile, while today 14,000 square miles are under quarantine, and the beetle has been found in some sections of seven states.

During this brief stay, it has clearly demonstrated what a serious pest it can become if allowed a free hand for a very long period. The injury to early apples and peaches amounts to 100 per cent of the crop if no control measures are taken. This has been clearly demonstrated in New Jersey during the summer of 1927, where abandoned fruit orchards have been swept clean by the beetle and where no spraying operations have been carried on for two years. Following a real estate boom of two years ago, scores of orchards are now without owners, and the rapid development of the pest in these neglected farms presents a new hazard in beetle control work.

Feeds on Many Plants

The wide range of favored foods of the beetle also presents another serious problem for its ultimate control. There are about 200 different plants, trees, shrubs and farm crops in New Jersey that are attacked by the beetles if no protection is offered. It is proving far more serious than most other pests that attack farm crops and fruit. While the codling moth is a serious pest of the apple, the beetle attacks scores of plants with an equal viciousness.

The biggest factor in the restriction of the beetle has been the establishment of a strict quarantine on the movement of all fruit and vegetables that are its favored food. There has at the same time been maintained an equally close watch on other articles of food that have the least chance of offering a hiding place or a means of spreading the beetle into uninfested regions. The quarantine has been carried to the point where inspection service is maintained in many of the large distributing centers where the beetles may have been brought in the market. The states of Delaware, Pennsylvania, New Jersey, New York and Connecticut are all contributing money to maintain this service.

Even this has not kept the beetle within bounds. Despite the close watch on every package of fruit or vegetable going outside of the territory, the beetle has continued to spread. The quarantine lines have been extended from year to year until today 14,000 square miles are included under the supervision of the beetle inspectors. In this area is included the entire state of New Jersey, northern part of Delaware, eastern part of Pennsylvania as far west as Harrisburg, New York City, lower New York state, sections of Long Island and two towns in Connecticut. The year 1927 saw a doubling of the area over the previous year, when less than 7000 square miles were watched.

Beetles Have Continued to Spread

In spite of this strict quarantine enforcement, the beetles have continued to spread. Neither can the blame be placed on the officials in charge of the inspection, nor can it be claimed that the beetles have been spread through the movement of either fruit or vegetables. This line of spread has been carefully checked. Inspection at destination of cars loaded in the beetle territory and certified as free from beetles has failed to disclose a single instance where beetles have been carried in this manner.

The tourist automobile and the railroad, particularly passenger coaches and cars of miscellaneous freight, have undoubtedly played a leading role in its spread. The recovery of beetles 100 or more miles from the heavily infested area and the finding of 200 beetles in a car of farm machinery at Harrisburg, Pa., is evidence that the beetle is spreading by other means than the transportation of fruit and vegetables.

To meet the situation of controlling the spread of the Japanese beetle, there has for 10 years been maintained at Riverton, N. J., a research laboratory, where every phase of the problem has been studied. Started in 1919 by a small appropriation from the United States Department of Agriculture, it has gradually been enlarged and its scope of activities increased to meet the situation as it grew in seriousness. As the beetle spread, the several states affected have contributed to the maintenance of the laboratory and the quarantine work.

Control Methods Developed

Despite the rapid spread of the beetle and the serious injury that it is causing, satisfactory control measures have been worked out. It is doubtful if any other pest in recent years has a more complete array of means developed for his downfall than now confronts the beetle. The entomologists have developed every line of attack that is practical, and last year's results in the field under varying conditions prove that they are on the right track for control.

Three lines of control have been found effective: the spraying of trees and shrubbery; the introduction of parasites, and the development of traps. Greater strides have been made during the past six months in developing a control than in any similar period since the pest became serious.

Fruit growers are now able, even in the heart of the most heavily infested sections, to get as much as 90 per cent protection on foliage and 95 per cent freedom from injury on the fruit. This is in direct contrast with orchards separated by only a line fence where the trees are 90 per cent defoliated and the fruit all ruined.

Grape growers are having a similar experience. One large vineyard turned over to the entomologists last spring showed 90 per cent protection, compared with 90 per cent injury where not protected, even though millions of beetles were found in the vicinity. Arsenate of lead has been the basis of all the control work on fruit trees. The growers, by changing their regular spray program, have been able to get a control on the beetle. The secret lies in more careful application and a slight modification of the applications and the poison content.

So successful has the control by spraying worked out that Moorestown, N. J., a community of several thousand inhabitants, put on a spray program for the community that saved every tree from injury. The new lead oleate coated arsenate of lead was used in the town, because it is more effective as a beetle control, while acid arsenate of lead was used on the fruit trees because the growers feared the residue of lead when it came to marketing the crop. The lead oleate coated arsenate of lead sticks much longer than ordinary arsenate of lead. It will stay on the foliage for an entire season, and the hot sun of July and August and the accompanying rains do not remove it from the tree.

Another feature of the spray program that offers promise as an effective control measure is the geraniol-pyrethum soap contact spray. While still in the experimental stage and ad-

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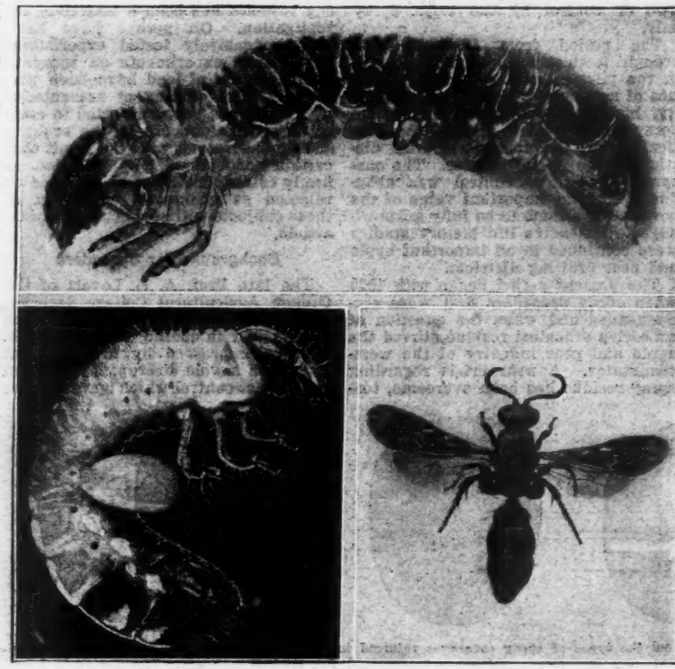
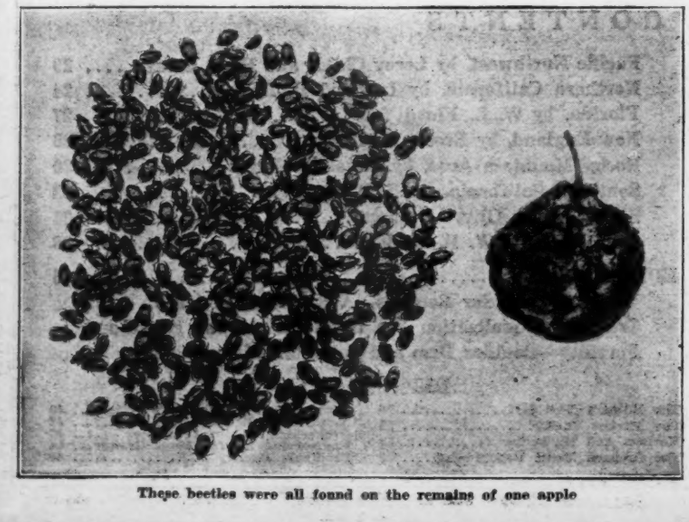


Above.—Enlarged picture of Japanese beetle grub with egg of Tiphia (a parasite) attached on the under side. Lower left.—Enlarged picture of grub with Tiphia egg after growth. Lower right.—Adult of Tiphia



These beetles were all found on the remains of one apple

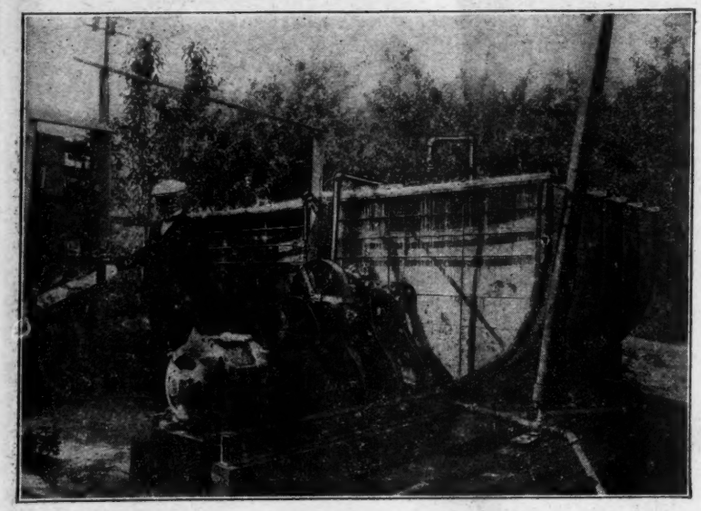
Japanese beetles like fruit as well as foliage. Approximately 1500 beetles were found on this small branch

Stationary Spraying Plants

By O. G. Anderson
Purdue University

Part I

THE OLD IDEA that necessity creates inventions is well illustrated in stationary spraying systems. Hayward Reed of Sacramento, Calif., discovered one morning that the river had moved over into his pear orchard, just as he was about to apply the scab spray. Realizing from previous experience that omitting this spray meant over 90 per cent of No. 2 and No. 3 pears, he mounted a sprayer on a barge and went to work. Before he could finish, the water receded, yet sprayers on wagons were useless. So he coupled up all the hose he could find and with a thousand feet of it continued spraying. This suggested an underground pipe system, which in the following year, 1908, enabled him to apply the scab spray on time during another great flood.



A 40-gallon per minute pump equipped with a 15 horsepower electric motor. It supplies two 25-acre tracts one-quarter mile apart. Six double nozzle guns have been used at one time. The orchards are sprayed in three to four days. Owned by Robert J. Graham of Cashmere, Wash.

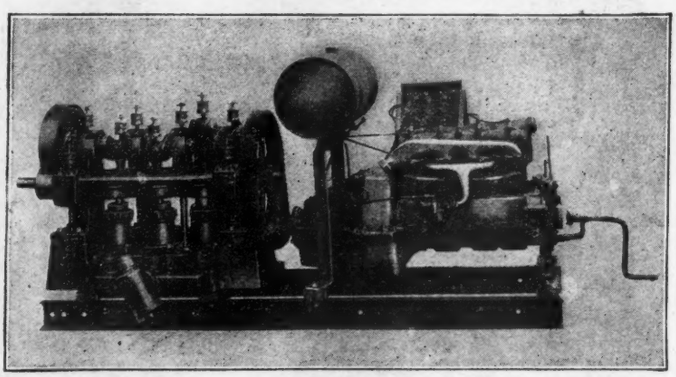
A. J. Dear installed a small plant at Wenatchee, Wash., in 1909, but not until William Moss of the same locality made a practical success of a 10-acre system in 1921, was the idea adopted generally by fruit growers.

There are today at least a dozen systems in California and several hundred in Washington. In the city of Wenatchee, 325 stationary plants were sold in 1925 as against 18 portable machines. Opinions are expressed that stationary plants are all right for small orchards but are too expensive and present mechanical difficulties in large plantings. But records show that these systems have been installed with considerable success in orchards varying in size from three acres to more than 400 acres. We have also heard that this method was suited chiefly to the irrigated apple sections of the Northwest. The largest installation on record will be found in the mountains of West Virginia, and large plants have recently been installed in the sandy level areas of New Jersey.

Advantages and Disadvantages of Stationary Outfits

Since they are being installed under these widely different conditions, it might be well to consider the advantages claimed for stationary spraying by different authors. They are:

Timely spraying, even though the ground is too soft for portable outfits.
No time lost by nozzlemen in refilling spray tank.
Spraying more easily performed in rough, hilly or mountainous country.
Does not disturb irrigation practices.
Damage to low hanging branches, fruit, intercrops and sod is reduced.
Men do not spray each other or wait for each other.
Electric motors may be used in place of gas engines.
Less strain on machinery and less of it to keep in repair.
Operating and fixed charges are low.



A 25-gallon pump with Ford engine attachment. A seven and one-half horsepower electric motor is furnished with this size of pump, but larger motors will doubtless be used in the future

The disadvantages usually claimed for the method are:

Too small pipes.
Leaky joints and valves.
Insufficient pressure.
Improper drainage of system.
Clogging and rusting of pipe lines.
Expensive to install.
Too much reliance placed on one central spray outfit.

Stationary Plants for Small Orchards

The smaller stationary units which have proved successful will first receive consideration. Later on a more elaborate type for large orchards will be discussed.

Among 12 plants of the earlier types installed around Wenatchee, no two were found to be alike in every respect, states O. M. Morris. Connections between tank and pump, as well as the engine, were original or individual in character, and the location of the plant varied from a central point to along any side of the orchard. Even the cost of installing these plants varied. One installed in a four-acre orchard cost $864, while one for a 12½-acre orchard cost $1250. Sometimes these figures were given with cost of pipe lines through the orchard, and sometimes this item was omitted. Installation costs for plants of recent construction in California have ranged from about $29 to $100 an acre. An average within this group seems to be around $37.50 an acre. Operating cost for a single application of spray has varied from $5.04 to $12.69 an acre, according to Moses and Duruz of the University of California. Naturally, the range in cost will vary for a spray application according to the size of the trees, the rate applied on each tree and the cost of the materials which enter into the spray. Furthermore, there is a range in cost of operating the plant itself, some being considerably more efficient than others.

Although there seems to be more uniformity with regard to the construction of stationary plants today, it is not likely that a uniform location will ever be adopted while plants are installed under such widely varying conditions. The location of a plant will doubtless be determined by some of the following factors: roads, water supply, topography of the land and the size of the orchard. Where electric motors are used as a source of power, the position of the power lines will sometimes determine the location. Even when these factors are taken into consideration, the usual location will be in the center of the orchard. In orchards of small acreage, heavy duty pumps have sometimes been removed from portable rigs and placed on a permanent foundation with tank and power adapted to the local situation. While this might prove satisfactory in small orchards, multiple units of such equipment would be necessary in the large orchards. This immediately presents the problem of stocking repair parts for all units. These units ordinarily will require separate tanks, and each tank will have its extra agitator and bearings, which must be kept water tight. These naturally add to the grief of the owner in the operation of his plant.

The Sprayer Tank

An arrangement frequently found is a small tank, placed at a comparatively high level, in which the stock materials are mixed. After they are mixed, they are drained into the tank below, from which the pump distributes the material throughout the orchard. Since the small tank does not serve any purpose which cannot be served by another arrangement, it is now being eliminated from newer plants. The least durable tank material is heavy galvanized iron. With proper care, it will last for a number of years, but is not so satisfactory as wood or concrete. Many growers are using the wooden tanks, installing two of equal size, sometimes placing them end to end. Because of the large size of these wooden tanks, they are usually installed separately, but may have a single agitator shaft operating both of them. Wooden tanks, of course, require more care than concrete tanks, so the latter are now becoming popular. It is not necessary to build two separate concrete tanks, but merely to build a partition about five inches wide in the middle of one large tank of the desired size. One of the tanks may be used for mixing the next batch of spray while the pump is emptying the other tank. By transferring the intake hose for the pump from one tank to the other, the arrangement takes care of both mixing and output. The sizes commonly used vary from 400 gallons each to 1000-gallons.

One owner favors two 600-gallon tanks; that is, he has a partition in the middle of a concrete tank holding 1200 gallons. This tank is 84 inches long, 54 inches wide and 65 inches deep. One agitator and one set of water-tight bearings takes care of a large output of spray material.

Foundation

The importance of having motor and pump perfectly aligned and securely anchored to the same foundation cannot be over-emphasized. One need only recall the care with which the manufacturer aligns the portable spray outfit on a steel bed to recognize

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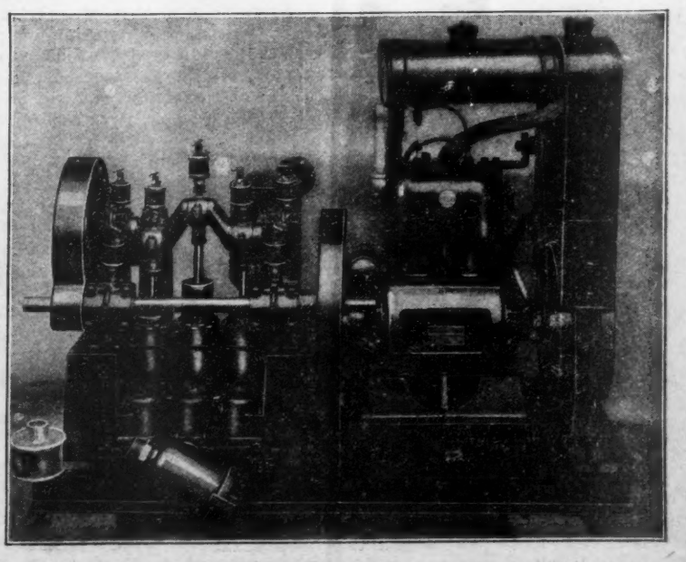


A 16-gallon pump equipped with an eight horsepower gas engine mounted on the same steel bed

American Fruit Grower Magazine
Established 1880.

C. E. DURST, Managing Editor.
Associate Editors:
MARY LEE ADAMS HAZEL BURSELL

Better Service for Readers

WE WANT to call your attention to an improvement started in this issue which will no doubt make the magazine more valuable to you. The quality of the paper is greatly improved. It is heavier and whiter than we have been using heretofore. The print will be easier to read on this paper, and the pictures will show more clearly. We shall continue to use this kind of paper in the future.

Another improvement consists in the four-page colored insert which is being used for the first time in this issue.

The circulation of the magazine now amounts to a quarter of a million readers. We thank our readers for the splendid co-operation they have given us, and we hope we shall be able to return this in the form of an improved magazine.

A Surplus Problem in Fruit Growing

IN THE January issue, some figures were presented which showed that the average annual carlot shipments of apples for 10 years were less than the number of carloads of bananas imported in 1926. Such figures might suggest to some readers that the large imports of bananas constitute a problem of concern to apple growers only. But such is not the case. The situation applies to growers of every fruit produced in the United States.

During the seven years from 1920-21 to 1926-27, the carlot shipments of all fresh and dried fruits grown in the United States varied from 263,835 cars in 1920-21 to 443,269 cars in 1926-27. The imports of bananas varied from 70,846 cars in 1920-21 to 105,496 cars in 1926-27. The banana imports were equal to 20 to 30 per cent of our total carlot shipments of all fresh and dried fruits during the different years.

There has been a lot of discussion of the surplus problem in grain and cotton farming in recent years, but it is a question if grain and cotton farmers have a more serious surplus problem than that created in the fruit industry by the imports of bananas. In years of light crops, as in 1927, there is no particular diffculty in disposing of the American fruit crop, but in years of large production, the problem is a difficult one. In 1926, for instance, thousands of bushels of fruit went to waste for want of a market. It is quite likely that if we had not imported bananas in an amount equaling 24 per cent of our carlot shipments of home grown fruits that year, a much larger proportion of our fruit crop could have been sold. Even if no increase in price whatever had been obtained, the selling of a larger part of the crop would have proved a great advantage to fruit growers. The fruit industry and all related industries would be in better condition now if they had not suffered the severe blow brought about by the surplus problem of 1926.

Equalization Fee Is Essential

A DETERMINED effort is being made in Washington to get the House Committee on Agriculture to report out the Farm Relief Bill without the equalization fee. The equalization fee is the very heart of the Farm Relief Bill. Without it, the farm relief measure would he worthless to agriculture. The Farm Relief Bill without the equalization fee is the same as a tariff would be without a duty. The bill is not worth working for if the fee is eliminated.

The Horse and Fertility

THE VALUE of the manure produced by horses, on the basis of 1000 pounds of live weight, is less than that produced by the dairy cow, the steer, the hog, the sheep, or the hen, according to figures published by the United States Department of Agriculture and several state colleges. At the same time, horse manure is more difficult of utilization in order to obtain its maximum fertilizing value than most other kinds; it loses nitrogen rapidly when stored under shelter and leaches badly if exposed to the weather.

Purdue University Circular 49 gives the following figures, showing the value of manure produced per year per 1000 pounds of live weight:

Sheep	$32.06
Dairy cow	28.07
Swine	25.48
Steer	21.75
Horse	19.88

That particular bulletin does not give the value of hen manure, but a Cornell University bulletin gives it as $36.20, which would place the hen at the top of the list.

Farmer's Bulletin 192, issued by the United States Department of Agriculture, states, regarding horse manure: "Horse manure is very dry and is, therefore, difficult to thoroughly mix with litter. It is a hot manure, undergoing fermentation rapidly and generating a high heat on account of its loose texture. It is likely to lose ammonia even more rapidly than sheep manure, and requires careful management from the moment it is voided."

The Cornell University Experiment Station made a test which showed that the loss in value of horse manure exposed to the weather during a period of six spring and summer months amounted to 65 per cent, as compared with 32 per cent for cow manure under identical conditions.

The above figures indicate that horse manure is of less value than that of other animals for fertilizing purposes. Thus the contention that tractors decrease fertility because they replace horses is not entirely substantiated, for in many cases the feed that would have been fed to horses is used for other animals. However, it must be conceded that the displacement of horses by tractors tends to reduce the total number of animals kept and thus diminishes the total amount of manure available. On the other hand, this is not a serious factor under good management, since sufficient legumes and cover crops can be grown in a good rotation system to keep the soil sufficiently rich in nitrogen and organic matter.

Boulder Dam and Columbia River Projects

BOULDER DAM and the Columbia River projects are sure to cause much discussion in Congress this winter. Both are enormous propositions and will require the expenditure of millions of dollars if approved.

As usual in such cases, these projects are being promoted largely in the name of agriculture. The people at home are being told how these projects will build up the country and bring prosperity to them. The people elsewhere are being told that the projects are necessary to provide for the growth of the country and to insure food for the millions. The support of business and industrial organizations is being solicited on the plea that the building of these projects will provide a large outlet for products in which they are interested.

But what is the truth about the matter? The Boulder Dam bill of last winter made no provision for irrigation whatever. Its exponents, however, suggested that the power developed could be used for pumping water from wells in the Imperial Valley and elsewhere. But as everyone knows, irrigation from wells is an uncertain proposition, as witness the experience in the Santa Clara Valley of California and other places. The argument is advanced that Los Angeles needs more water, but information from apparently reliable sources indicates that Los Angeles has plenty of water for some time to come.

Regarding the Columbia River project, the promoters emphasize the large area of agricultural land that will be brought into production. But data from reliable sources indicates that the assessments which will result will be larger per acre on the reclaimed land than can possibly be made from it under existing economic conditions.

It is a significant fact that a large proportion of the fruit growers and farmers in the sections involved do not want these projects approved. Many of the other citizens also question their value. Thinking persons all over the country feel it is unwise national economy to bring more land into production under present conditions. The reports of the National Industrial Conference Board, of the Business Men's Commission, and of the Association of Land Grant Colleges and Experiment Stations discouraged the extension of our productive area at the present time. A special committee of the American Society of Engineers disapproved the development of further reclamation projects at this time. The projects seem to conflict with the spirit of the President's recent message to Congress. Finally, it should be borne in mind that of the irrigation projects already built with government aid, only 40 per cent of the land involved is producing and 60 per cent is lying idle. Thousands of fruit growers and farmers have spent their life's earnings and have worked themselves into a broken condition trying to make a success on some of these lands.

When the matter is sifted down, it resolves itself into a question of power. While much is being said about agriculture, the underlying object of the persons interested is to get cheap power with government help, power which they are financially unable to secure by themselves. We do not know what the needs are for more power, but if any exist, it would seem to be the duty of financial interests to work the matter out through private initiative rather than with government help. The government has already subsidized too many propositions of this kind, to the great disadvantage of other classes of society.

A New Standard for Spray Schedules

By H. W. Thurston, Jr.

Pennsylvania Agricultural Experiment Station

APPLE GROWERS are all familiar with what is known as the spray schedule—a set of rules by which they undertake to keep in subjection the numerous diseases and insect pests which menace their orchards. How many, I wonder, have ever stopped to consider how such a set of rules ever came to be formulated? How many have paused to consider why they use lime-sulphur and Bordeaux and not salt or sugar or sulphuric acid, why arsenic and nicotine instead of strychnine and caffeine or some other poison, or why the schedule recommends spraying at a certain time in preference to some other time?

Early Development of Spraying

There are among the apple growers of today not a few whose memory goes back to the time when spraying an apple tree was a thing unheard of; to the time when lime-sulphur and Bordeaux mixture were unknown quantities. The man who can remember these "good old days" need not be so very old, for it is just 44 years since the accidental discovery in France of Bordeaux mixture, still probably the best all-around fungicide in existence, and it is barely 15 years since lime-sulphur first began to be generally popular.

The first experimental spraying of apples in this country for scab control was done in New York state in 1884. In this early work the materials used were (1) a solution of hyposulphite of soda, (2) sulphide of lime and (3) a mixture of sulphur and water. In 1887, the United States Department of Agriculture recommended spraying with iron sulphate "before the buds have commenced to expand" and with Bordeaux mixture "as soon as the fruit has set." Some years earlier (1873) Illinois had begun to recommend spraying or "syringing," as it was then called, with Paris green water for controlling the codling moth. In 1889, Ohio was the first to try to combine an insecticide with a fungicide in the same solution, though such combinations were not at first used on apples.

Development of a Calendar or Schedule

Once the discovery of effective insecticides and fungicides had been made and their efficiency satisfactorily demonstrated, attention began to turn to the question of the best time to apply these materials to secure the greatest benefit. Growers who were troubled with scab and with insects—and what grower was not?—began to ask for more information. "When; how often; how; how much; and with what shall we spray for this, that, and the other disease or insect pest?" were questions that every state experiment station had to attempt to answer. The recommendations which the various stations put forth were at first quite variable, as might be expected in a country with such a range of climate and topography as ours. Gradually, however, a semblance of order and more or less uniformity became apparent in the various state recommendations for the control of specific diseases or insects. The spray calendar or schedule as we have known it through all its changes in recent years has been an expression of the best knowledge concerning the effectiveness of time and material. It has come into being as a direct result of attempts to answer the numerous questions of the grower.

The average schedule for apples in recent years has recommended from four to seven or eight applications of spray material, each application timed according to a certain stage of development of the flowers, leaves or fruit of the apple. The effort has been to combine fungicides and insecticides with timeliness of application in such a way as to control with the smallest possible number of applications the greatest number of diseases and insect pests. To emphasize the necessity for timeliness of application, the grower has been taught to spray "when the central buds of a flower cluster show pink; when three-quarters of the petals have fallen; 10 days, or three weeks or six weeks after the petals have fallen," etc.

When Should We Spray?

This emphasis on timeliness has been well placed, but we are coming to realize that the manner of determining just when the proper time is, has been somewhat at fault. A parasite, whether insect or fungous, does not time its depradations according to the period of blooming, or the size of leaves or fruit on an apple tree, but every parasite has its own cycle or life history, which is repeated every year. The various stages in the cycle of development of a parasite may and do vary with local conditions. The climate, the weather, and especially variations in temperature and moisture, are some of the things which help to determine when a parasite will reach a stage of development during which it is capable of making its attack. Accordingly, in preparing to make a timely application of an insecticide or fungicide, it becomes necessary to watch the parasite rather than the tree.

Taking apple scab as an example, we cannot say that the scab fungus first shoots its spores when the apple flower buds are turning pink. Yet this is what the spray schedule has assumed to be true. Actually, the fungus may discharge its spores a week earlier than "blossom pink," and the grower who has depended upon the spray schedule and waited until his trees were in this condition, wonders why he did not get control of scab this year. On the other hand, the fungus may not be ready until several days after the "blossom pink" stage, and the grower who sprayed according to schedule has wasted his time and much valuable spray material, when possibly he might better have finished his pruning. The point is that the date on which the apple scab fungus matures its spores is not determined by the condition of the apple tree, but depends upon the temperature and moisture conditions of January, February and March. Whether or not the fungus will discharge its spores after they are mature depends not upon the color of the apple blossoms, but upon the rainfall at the time the spores reach maturity.

The spray schedule which says "spray when the buds show pink," may be about right part of the time, but it is wrong often enough to make real control of diseases or insects a rather uncertain proposition. To depend on such a schedule is like trying to catch a train and depending upon a time table which the railroad specifically says is subject to change, without notice. Perhaps you make the train and perhaps you don't. Anyone can tell when the buds on his trees are pink or can see when the petals have fallen, and that is supposed to be the beautiful thing about a spray schedule. The inaccuracies of this method of timing spray applications are, however, becoming apparent to the grower as well as to the specialist, with the result that the man who is most interested in getting the upper hand of orchard pests, is learning to focus his attentions more or less directly on the pest itself.

The Spray Service Idea

This change in viewpoint has been coming gradually to the front during the past three or four years and is resulting in closer contact and increased co-operation between the grower and his agricultural experiment station. The grower has realized the shortcomings of the spray schedule, but has found it beyond his power to tell when the scab spores are ready to do business or to prophesy whether his apples are liable to become infected with scab if it rains day after tomorrow. Here is where the idea of spray service enters in. It is an idea that seems to have originated in New York state, but at the present is being rapidly developed in many other states as well.

(*Concluded on page 33*)

"San Jose Scale Saved My Orchard"

By J. H. Merrill

"IS THIS George T. Groh?"

"It is."

"I have a letter of introduction to you from a friend of yours at the agricultural college. He told me that if I were ever near Wathena, Kans., and wanted to see a real orchard, to stop off and visit you."

"I am glad to meet any of Ted's friends, and as I have a little time to spare right now, let's take a walk around and look things over. I am going to bale alfalfa this afternoon, but I am not particularly busy this morning.

"Let's start at the old orchard, because that is where I started. My father planted these trees, and they are now about 30 years old. As you notice, he headed them rather high so that he could get under them with a mowing machine. I know that it isn't considered good orchard practice to grow alfalfa in an orchard; in fact, few soils would support both an orchard and alfalfa at the same time. Yet, this loess soil in the Missouri Valley is so rich that we actually did cut alfalfa from this orchard for a number of years. Since the trees were high headed and were growing on such rich ground, they grew so tall that it really constituted one of my greatest problems.

"Perhaps you might care to hear how I happened to become interested in modern orcharding. As I told you before, my father set out this orchard, and although there are nearly 600 trees here, we never harvested over 750 bushels of apples in any one year, and they were poor quality at that.

Protection from the River

"The Missouri River makes a bend around my place, and for years we had been told that we mustn't expect to raise apples in the 'bottoms' because our crop would be hit by frost every year. Since then, however, I have come to learn that that old river is really the best friend I have as far as frost protection is concerned.

"To go back to my story, though, it was the San Jose scale that saved my orchard. That astonishes you, doesn't it? Well, it's a fact, nevertheless, and it is only another case of a supposed misfortune turning into a blessing. It all happened in this way.

"The state orchard inspector called at my house one day and said that he had located San Jose scale in my orchard. He further informed me that there was a state law which required that I either spray my orchard with a dormant spray or else cut out the infested trees. If I failed to do this, the state would do it for me and charge me for the work done. This news, coming on top of our poor crops, was what you might call the 'straw that broke the camel's back.' I thought the matter over pretty carefully, and after talking it over with my wife, I finally decided to cut the trees down and turn this lot into a hog pasture.

"One February morning, just as I was beginning to chop, the orchard inspector brought around the new assistant state entomologist. He didn't do this to rub in my misfortune but he simply wished me to become acquainted with the new man in charge of the work.

Apple blossom time in the old orchard

Entomologist Recommends Saving the Trees

"Now, you know I don't believe that such things 'just happen,' for when they came I had only two or three trees down, and they were so far gone that they should have been taken out of the orchard long ago. This new entomologist was an easterner, and I asked him in to have a bite because I liked to listen to his eastern accent. He didn't seem at all alarmed about this San Jose scale business, in fact, he hardly mentioned it. What seemed to bother him was the cutting down of all these fine trees. I guess they look at those things differently in New England than we do. If they should cut out an orchard back there, they probably would put up a bronze tablet saying that 'this is the site formerly occupied by John Black's orchard.'

(*Continued on page 39*)

Spraying and Dusting Schedules for Michigan

By W. C. Dutton, Michigan State College

In these schedules, recommendations are made for spraying and dusting. The value of the spraying treatments recommended have been well established, and satisfactory control may be expected if the materials are used at the proper strength, if they are properly mixed and if the applications are made at the correct periods. The value of the dusting method has been well established for certain uses, but with some fruits the results have not always been satisfactory for such troubles as apple scab, cherry leaf spot or codling moth when conditions were favorable for their development and spread. Because of the many advantages of the dusting method, many growers prefer to use it for all or part of the applications, but it should be borne in mind that in bad years it is easier to get control with sprays than with dusts. Some growers use dust for the entire season; others spray for the early applications and dust later; and still others may use it in emergencies when it is not possible to cover the orchard at critical times with the available spraying equipment. With both dusting and spraying, the schedules are intended to cover rather severe conditions. Some growers may not find it necessary to make all the recommended applications, but under severe conditions even more may be necessary. Dry lime-sulphur may be substituted for the liquid on the basis of four pounds of the dry to one gallon of the liquid. Oil sprays are desirable in many ways, but their continued use is not now recommended.

APPLES

Time of Application.	Materials to Use — Spraying.	Materials to Use — Dusting.	For Control of.	Remarks.
(1) Dormant. Apply as late as possible before growth starts, or—	Lime-sulphur 12½ gal., water to make 100 gal.	Use liquid spray, as dormant dusts cannot be recommended at present.	Scale insects.	The dormant may be used when spraying for scale only, otherwise use the delayed dormant. Oil sprays, either commercial or home-made, will give excellent control of scale and are necessary in case of leaf roller or red mite. They may usually be expected to give control of aphids if applied thoroughly enough.
(1a) Delayed dormant. Begin when fruit buds show silvery and finish by time they are in "squirrel's ear" stage.	Lime-sulphur 12½ gal., nicotine sulphate 1 pint, water to make 100 gal.	Use liquid spray as recommended, except possibly for aphids. See application No. 2.	Scale insects, aphids.	
(2) Pre-pink. Apply about midway between delayed dormant stage and when buds begin to separate in the clusters.	Lime-sulphur 2½ gal., water to make 100 gal. The nicotine sulphate (1 pint in 100 gal.) may be used to advantage now if not included in the delayed dormant.	Sulphur dust. If dust is used for the rosy aphis, apply at this time, using not less than 2% nicotine.	Scab.	If bud moth is prevalent, add lead arsenate in this or the delayed dormant stage. Under bad scab conditions, make another application of dust between pre-pink and pink.
(3) Pink or cluster. Apply as soon as possible after the buds seperate in the cluster.	Lime-sulphur 2½ gal., arsenate of lead 2 lb., water to make 100 gal. If red bug is present, add 1 pint nicotine sulphate.	90-10 sulphur-lead dust. For red bug use nicotine dust 2%.	Scab, fruit worm, leaf roller and other chewing insects.	The use of lead arsenate at this time is not always necessary, but its use is good insurance.
(4) Calyx. As soon as most of petals have fallen.	Lime-sulphur 2½ gal., arsenate of lead 2 lb., water to make 100 gal. If red bug is present, add nicotine sulphate 1 pint.	90-10 sulphur-lead dust from one side and repeat from other side in 1 week. Use dust containing 2% nicotine if red bug persists.	Scab, codling moth, curculio, fruit worm, red bug.	This application should not be delayed after petal fall because of danger from scab.
(5) Ten-days or 2-weeks. Should be completed in two weeks after calyx spray.	Lime-sulphur 2½ gal., arsenate of lead 2 to 3 lb., water to make 100 gal.	90-10 sulphur-lead dust from same side as in calyx spray. Repeat from other side in about 1 week.	Scab, codling moth, lesser fruit worm and other chewing insects.	Dry-mix sulphur-lime or a wettable sulphur may be substituted at this time or in later sprays for lime-sulphur if scab is well under control.
(6) Thirty-day. Complete about 30 days after calyx spray.	Lime-sulphur 2 gal., arsenate of lead 3 lb., water to make 100 gal.	90-10 or 85-15 sulphur-lead dust applied as two half applications at 1-week intervals.	Codling moth, scab.	This application is not necessary in many districts, but is good insurance where codling moth is serious. The lime-sulphur may be omitted entirely unless scab is present.
(7) Second brood. Apply at time recommended by experiment station entomologist.	Lime-sulphur 2½ gal., arsenate of lead 3 lb., water to make 100 gal.	85-15 sulphur-lead dust applied as two half applications at 1-week intervals.	Codling moth, scab.	

PEARS

Time of Application.	Materials to Use — Spraying.	Materials to Use — Dusting.	For Control of.	Remarks.
(1) Dormant. In early spring before psylla eggs are laid.	Oil emulsion 3%; or miscible oil as directed by manufacturers.	No dust available. Spray with lime-sulphur 12½ gal., water to make 100 gal.	Scale insects, blister mite, psylla.	If scale or blister mite only is present, lime-sulphur 12½ gal., water to make 100 gal., will be satisfactory. If scab only is to be controlled, use Bordeaux or weak lime-sulphur for spraying or sulphur dust for dusting in the delayed dormant.
(1a) Delayed dormant. Apply after buds can be seen in the cluster, but must be completed before they separate.	Lime-sulphur 2½ gal., water to make 100 gal.; or 2-4-50 Bordeaux (see Remarks).	Sulphur dust (see Remarks).	Scale insects, blister mite, scab, psylla eggs.	
(2) Pink or cluster. Apply when buds have separated in the clusters.	2-4-50 Bordeaux.	Sulphur dust.	Scab.	This application is not necessary in many parts of the state where pear scab is not prevalent.
(3) Calyx. Apply as soon as petals have dropped.	Nicotine sulphate 1 pint, lime 40 to 50 lb., 2-4-50 Bordeaux 100 gal.	90-10 sulphur-lead dust. For psylla use a 2% to 3% nicotine dust 7 to 9 days later.	Scab, codling moth, psylla.	If scab is not a factor, omit the Bordeaux but use the poison. If psylla is not present, omit the nicotine and excess lime from the spray or nicotine dust from the dust treatment. This applies for both the calyx and 2-weeks applications.
(4) Two-weeks. Apply 2 weeks after petals have fallen.	Nicotine sulphate 1 pint, lime 40 to 50 lb., 1-4-50 Bordeaux 100 gal.	90-10 sulphur-lead dust. For psylla use nicotine dust 2% to 3% 2 weeks after first nicotine dust treatment.	Scab, codling moth, psylla.	
(5) Second brood. Usually about first of August.	Arsenate of lead 3 lb., 1-4-50 Bordeaux 100 gal.	85-15 sulphur-lead dust.	Scab, codling moth.	When scab is not a factor, use only arsenate of lead. The use of poison at this time is advisable only on winter varieties because of danger of arsenical residue.

Note—If psylla appears during mid or late summer, make extra applications of nicotine sulphate and lime as a spray or nicotine as a dust.

PEACHES

Time of Application.	Materials to Use — Spraying.	Materials to Use — Dusting.	For Control of.	Remarks.
(1) Dormant. Apply in early spring before buds begin to swell.	Lime-sulphur 12½ gal., water to make 100 gal.	Spray with lime-sulphur 12½ gal., water to make 100 gal.	Leaf curl, scale insects.	This application must be made before growth starts to be fully effective.
(2) After blossoms have dropped and most of "shucks" have fallen.	Arsenate of lead 2 lb., lime 8 to 10 lb., water 100 gal.	Lead arsenate-hydrated lime dust (10% arsenate of lead); or 80-10-10 sulphur lead-lime.	Curculio.	Arsenate of lead should never be used on peaches without lime. This applies for both dust and spray. Serious injury may follow if this precaution is not observed.
(3) Two-weeks. After "shucks" have fallen.	Dry-mix sulphur-lime 25 lb., arsenate of lead 2 lb., fresh hydrated lime 8 lb., water to make 100 gal.	80-10-10 sulphur-lead-lime dust.	Curculio, brown rot, scab.	
(4) One month before fruit ripens.	Dry-mix sulphur-lime 25 lb., arsenate of lead 2 lb., fresh hydrated lime 8 lb., water to make 100 gal.	80-10-10 sulphur-lead-lime dust.	Brown rot, scab, curculio.	This is important with many varieties for brown rot and scab. If curculio is not present the poison may be omitted as well as the excess lime.
(5) One week to 10 days before harvest.	Sulphur-casein spray or a wettable sulphur.	Sulphur dust.	Brown rot.	This is especially valuable with many early varieties, or with any that are susceptible to rot, and in rainy, muggy weather.

GRAPES

Time of Application.	Materials to Use — Spraying.	Materials to Use — Dusting.	For Control of.	Remarks.
(1) When shoots are 8 to 10 in. long.	4-4-50 Bordeaux.	Copper-lime dust containing 20% monohydrated copper sulphate.	Black rot, downy mildew.	
(2) Just before the blooming period.	Arsenate of lead 3 lb., 4-4-50 Bordeaux 100 gal.	Copper-lime dust with 10% to 15% arsenate of lead.	Black rot, berry moth, downy mildew.	If rose chafer is prevalent, more arsenate may be necessary.
(3) Just as blossoms are falling.	Arsenate of lead 3 lb., 4-4-50 Bordeaux 100 gal.	Copper-lime dust with 10% to 15% arsenate of lead.	Black rot, berry moth, downy mildew.	A very important application.
(4) About two weeks after No. 3.	Arsenate of lead 2 lb., 4-4-50 Bordeaux 100 gal.	Copper-lime dust with 10% to 15% arsenate of lead.	Black rot, berry moth, mildew.	The necessity for the spray at this time will depend on conditions, but the dust should not be omitted, although the poison may sometimes be left out.
(5) Just before the berries touch in the clusters.	Arsenate of lead 2 lb. or more, resin fish-oil soap 2 lb., 4-4-50 Bordeaux 100 gal. Spray upward with short rod and angle nozzle.	Copper-lime dust with 10% to 15% arsenate of lead.	Black rot, berry moth, mildew.	This application is very important for berry moth. If hoppers are not present, the nicotine is not necessary. The hopper treatment may usually be made at this time but should be delayed if necessary until the oldest nymphs get wings. Do not delay the berry moth treatment later than indicated. The nicotine sulphate cannot be combined with copper-lime dust, but may be used immediately before or after. If factory mixed dust is used, 3% of nicotine is desirable.
	Nicotine sulphate 1 pint in 100 gal. of spray. Combine with No. 5 if possible. Otherwise make separate spray, using nicotine sulphate 1 pint, resin fish-oil soap 2 lb., water 100 gal.	Nicotine-lime dust 2%. This must be a separate application from the copper dust.	Leaf hoppers.	

CHERRIES AND PLUMS

Time of Application.	Materials to Use — Spraying.	Materials to Use — Dusting.	For Control of.	Remarks.
(1) Dormant. Apply just before growth starts.	Lime-sulphur 12½ gal., water to make 100 gal.	Spray, using lime-sulphur 12½ gal., water to make 100 gal.	Scale insects.	This is seldom necessary on sour cherries and not often on sweet.
(2) Petal-fall. Just after petals have dropped.	Lime-sulphur 3 gal., arsenate of lead 2 lb., water to make 100 gal. (For sweet cherries never use more than 2 gal.)	Copper-lime dust containing 20% monohydrated copper sulphate and 10% arsenate of lead; or 90-10 sulphur-lead dust.	Leaf spot, slug, brown rot, curculio.	Dry-mix sulphur-lime spray 25 lb., water to make 100 gal., will usually be a satisfactory substitute for lime-sulphur on sweet cherries. This is unlikely to cause foliage injury. The dust applications should be split in halves and applied from opposite sides of the trees at weekly intervals.
(3) Two-weeks. Should be complete within 2 weeks after petal-fall.	Lime-sulphur 3 gal., arsenate of lead 2 lb., water to make 100 gal.	Copper-lime dust with 10% arsenate of lead; or 90-10 sulphur-lead dust.	Leaf spot, brown rot, curculio, slugs.	
(4) Four weeks after petal-fall.	Lime-sulphur 3 gal., arsenate of lead 2 lb., water to make 100 gal.	90-10 sulphur-lead dust.	Leaf spot, cherry maggot, curculio, slug, brown rot.	This and No. 5 are important for the control of the cherry maggot or fruit fly. If the fruit goes to the canner and will be well washed, omit poison from No. 4 and apply No. 5 when advised by experiment station entomologist.
(5) When fruit flies emerge.	Arsenate of lead 2½ lb., water 100 gal.	90-10 sulphur-lead dust.	Cherry fruit fly.	With sweet cherries (or sour cherries that are left for late harvest) extra applications of sulphur dust without poison are desirable to prevent brown rot injury.
(6) After harvest. Just after fruit is picked.	Lime-sulphur 3 gal., arsenate of lead 1 to 2 lb., water to make 100 gal.	90-10 sulphur-lead dust.	Leaf spot, slugs.	This is desirable to prevent late summer defoliation.

Plums—In general, plums are most often injured by leaf spot, brown rot and curculio and require the same type of treatment as cherries. If scale is present, make application No. 1 and follow with Nos. 2 and 3 about one month before harvest. The local prevalence of curculio should determine how many times arsenate of lead should be used. In general, poison in Nos. 2 and 3 is sufficient. Use lime-sulphur at the rate of 2½ gal. in 100 gal. of spray, except on Japanese plums, for which dry-mix sulphur-lime spray should be used as on peaches. The late application of sulphur dust just before harvest is often very valuable for the control of rot.

Cherry Aphids—If the black cherry aphid is present, use nicotine sulphate 1 pint, and soap 2 to 3 lb., to 100 gal. of water just before blossoming. Drench the trees. Repeat during the summer if necessary.

CURRANTS AND GOOSEBERRIES

Time of Application.	Materials to Use — Spraying.	Materials to Use — Dusting.	For Control of.	Remarks.
(1) Dormant. Apply before growth starts.	Lime-sulphur 12½ gal., water to make 100 gal.	Lime-sulphur-copper-lime dust.	Scale insects.	Apply only if scale is present.
(2) When leaves are ¼ to 1 in. in diameter.	Arsenate of lead 2 lb., nicotine sulphate 1 pint, 4-4-50 Bordeaux 100 gal.	Copper-lime dust (20%) with 10% lead arsenate. Use nicotine dust separately if aphids usually cause trouble.	Leaf spot, leaf-eating insects, aphids.	Very thorough application is necessary to insure aphid control.
(3) Soon after blooming period.	Arsenate of lead 2 lb., 4-4-50 Bordeaux 100 gal.	Copper-lime dust (20%) with 10% lead arsenate.	Leaf spot, leaf-eating insects.	If aphids persist and have not been treated earlier, use nicotine spray or dust.
(4) Ten days to two weeks after No. 3.	Arsenate of lead 2 lb., 4-4-50 Bordeaux 100 gal.	Copper-lime dust (20%) with 10% lead arsenate.	Leaf spot, leaf-eating insects.	
(5) Just after the fruit is harvested.	Arsenate of lead 2 lb., 4-4-50 Bordeaux 100 gal.	Copper-lime dust (20%) with 10% lead arsenate.	Leaf spot, leaf-eating insects.	The necessity for this treatment will depend on local conditions and the varieties grown.

RASPBERRIES AND DEWBERRIES

Anthracnose—The only common disease of the brambles that is controllable by spraying is anthracnose. It can be greatly reduced, if not entirely eliminated, in new plantings by removing the portion of old cane usually left attached to the tip. This should be cut off at the time of planting so that no part of it protrudes above ground. Remove these pieces from the field. If anthracnose is present, spray as follows:

(1) When buds show green, using liquid lime-sulphur 10 gal., water to make 100 gal. The addition of 1 lb. of casein-lime spreader will improve the spray.

(2) About 1 week before the blossom opens, using Bordeaux 2-4-50. Lime-sulphur used at this time will control the disease but may cause serious injury.

Blackcap raspberries and dewberries usually need spraying every year, but red varieties are seldom affected by the disease.

GENERAL REMARKS

Arsenate of Lead—The directions in these schedules are based upon powdered arsenate of lead; if the paste form is used, double the amount.

Lime-Sulphur—The directions in these schedules are based upon the use of lime-sulphur concentrate testing 32 to 33 degrees Baume.

When It Rains, Look Out for Scab

By I. T. Pickford

IN MANY of the fruit producing sections of the country, the past season was a tough one in which to bring through a clean crop. Apple scab was insidious in its attack; green aphis spread corruption during mid-season; and the codling moth in its social activities openly flouted all the usual conventions.

Therefore, at farmers' meetings this winter we may expect to see all the old alibis dragged forth, as well as the promulgation of wonderful new ones.

Such being the case, it is not going to be easy for the doubting Thomases to butt in with the time-worn dodge: "Well, how do you account for So and So's orchard? He didn't do a thing, and the crop was pretty good."

Man Behind the Gun Counts Most

This season has again forcibly demonstrated that it is the man behind the gun which counts most in the battle to control bugs and diseases. Unfortunately, too many growers are apt to spend their energy learning history as so many events to be memorized instead of understanding causes and effects. It is not so much the kind of materials, or the specific dates or the kind of machine used. Kinds of materials and machines are items to be considered after one knows all about the whyfores of their use. No two seasons were ever alike as regards temperature and rainfall, winds and humidity. And these exercise great influence on the behaviour of all kinds of pests and their parasites.

At the close of the season, it became apparent that only the best operators with either liquid sprays or dusts had brought through a clean crop of fruit. Careless growers had failed with every kind of dope on the market. Some had succeeded on a part of their orchards, and they began to diagnose the reasons.

Some Michigan Experiences

A prominent apple man near Hart, Mich., had quite a bad dose of scab on one side of the trees in a certain part of the orchard. Investigating the matter, he discovered that here was where the crew had waited for the wind to change before doing the opposite side. Another grower near Watervliet had only a portion of his orchard covered in the delayed dormant stage up to the night of April 19. It rained that night. Scab spores were shooting. Moisture and temperature remained favorable for this fungus over a period of eight hours or more. The result was a primary scab infection.

This primary dose of scab came along about a week later over in the eastern part of the state, which quite likely helps account for a higher percentage of clean orchards in that section. However, the careless growers even there found their fruit polluted with the disease. The delay in arrival of the first scab rain had permitted many growers to get covered up before the attack.

A Galesburg grower prevented scab on Spy where he dusted them in a block of interplanted McIntosh and Spy at calyx time for the McIntosh, but where he waited for the Spy to come to their true calyx stage, quite a sprinkling of scab had crept in.

I asked a certain apple grower who had a clean crop in a locality where good stuff was rather a novelty what kind of a schedule he followed. "Well," he replied, "I kept plugging away steady every day I could up to blossom time." In other words, he had fought back the best he was able to in a season when moisture conditions made it impossible to follow one of the old set guide-post schedules.

Rain and Warm Weather Encourage Diseases

Most fungous diseases attack under a barrage of rain. With the moisture, however, some diseases like a warm temperature, as, for instance, the cherry shot-hole leaf spot. On the other hand, certain types, like the California peach leaf spot, prefer cool weather.

The man on the ground who is responsible for a fruit crop must ever be able to decide on the best line of action after he has secured all the information possible. For the time comes when it seems as though everything is different than the usual season. The old time signs and weather bureaus too will sometimes fail to get the right angle on forecasts of storms. Insects will emerge at your vacation time and their parasites fade out of the picture.

So the man on the firing line must know and at the same time have the gumption to act. Often this will mean a violation of regular union hours and continued effort when arms are weary and eyes are full of smarting spray dope. He will many times wonder, "Shall I save the price of an application at this time or put it on as a sort of special insurance?" One may gamble, and most growers do more or less, but the most successful managers at all times consider the maximum damage that might occur if adequate coverage is not maintained. They prefer an insurance application to taking possible costly chances.

Constant Protection Is Good Insurance

It may be thought that to follow such a program of constant protection will incur an expense beyond any hope of profit. But such is not necessarily the case. This past season those people won out who did what weather conditions demanded of them in the way of frequency of applications, for good fruit sold for better money than in the average year.

The first spray on sour cherries was allowed to drag along until late in many instances last spring because the buds had been seriously injured by frost. A good crop was not in sight, and besides, it was too cold for pleasure much of the time. However, there was plenty of moisture and infection took place as tiny spots which, as soon as warm weather came along, caused the trees to become full of those disgusting yellow leaves.

Scab Infection in New York

G. E. Smith and R. L. Palmer, fruit specialists of Orleans county, New York, have supplied some figures that reveal the great diversity of results as the consequence of omitting certain applications over a range of years. These figures refer to scab control and are quoted as percentages of the fruit infected.

RESULTS FROM SPRAYING IN ORLEANS COUNTY, NEW YORK.

	Percentages of Infected Fruit.					
	1918	1919	1920	1921	1922	1923
All sprays omitted	99	63	4	3	98	100
No sprays omitted	16	1	1	0	3	6
Delayed dormant omitted	27	37	5	1	4	21
Pre-blossom omitted	53	25	1	0	4	25
Calyx omitted		24	2	2	65	37

During this period, scab was serious in four out of six years. In 1918, there was 16 per cent of scab even though no sprays were omitted, which indi-

(*Concluded on page 39*)

Spray Calendar for the Middle West

By T. J. Talbert, University of Missouri

APPLES, PEARS AND QUINCES

Time of Application.	Materials to Use.	For Control of.	Remarks.
(1) Dormant or delayed dormant. Generally most satisfactory just as blossom buds are swelling in spring.	Lime-sulphur 14 gal., water to make 100 gal.; or cold or boiled lubricating oil emulsion 3 gal., water to make 100 gal.	San Jose scale and other scale insects.	Proprietary miscible oils should be used at dilution recommended by manufacturers.
Special spray. When buds are opening and aphid eggs are hatching.	Oil emulsion 3 gal., water to make 100 gal.	Plant lice (aphids), San Jose scale.	Effective against aphids and scale. Apply before blossoms open.
(2) Cluster bud spray. When buds begin to separate but before they open.	Lime-sulphur 2½ gal., arsenate of lead 2 lb., water to make 100 gal.; or 3-4-50 Bordeaux 100 gal., arsenate of lead 2 lb.	Apple scab, leaf spot, curculio, canker worm.	Add 1 to 1½ pints nicotine sulphate when aphids are serious.
(3) Second summer or calyx spray. Start when bloom is two-thirds off and finish before the blossom ends close.	Lime-sulphur 2½ gal., arsenate of lead 2 lb., water to make 100 gal.	Codling moth, plant lice (aphids), curculio, canker worm, apple scab, black rot, leaf spot.	Most important summer spray. Should be applied within a week after petals fall to be most effective.
(4) Third summer spray. Within 12 or 14 days after calyx spray.	Lime-sulphur 2½ gal., arsenate of lead 2 lb., water to make 100 gal.	Apple blotch, curculio, codling moth, lesser apple worm, apple scab, leaf spot, phoma spot.	Where apple blotch or phoma spot is serious, use 3-4-50 Bordeaux instead of lime-sulphur.
(5) Fourth summer spray. Twelve to 14 days after No. 4.	Lime-sulphur 2½ gal., arsenate of lead 2 lb., water to make 100 gal.	Apple blotch, curculio, codling moth, lesser apple worm, apple scab, leaf spot, phoma spot, sooty blotch.	Where apple blotch or phoma spot is serious, use 3-4-50 Bordeaux instead of lime-sulphur.
(6) Fifth summer spray. Twelve to 14 days after No. 5.	Lime-sulphur 2½ gal., arsenate of lead 2 lb., water to make 100 gal.	Apple blotch, curculio, codling moth, lesser apple worm, apple scab, leaf spot, phoma spot, sooty blotch, bitter rot.	Where apple blotch or phoma spot is serious, use 3-4-50 Bordeaux instead of lime-sulphur.
(7) Sixth summer spray. Twelve to 14 days after No. 6.	Lime-sulphur 2½ gal., arsenate of lead 2 lb., water to make 100 gal.	Apple blotch, curculio, codling moth, lesser apple worm, apple scab, leaf spot, phoma spot, sooty blotch, bitter rot.	Make later sprays at intervals of 12-14 days when required for codling moth or bitter rot.

Dusting—Comparatively few growers are now using dusts in apple orchards because experience and observations have generally shown that where either diseases or insects are serious, liquid sprays usually give better results. Nevertheless, there has recently been a revival of interest in dusts in the central states. The best that the Missouri Agricultural Experiment Station can say at this time, however, is that dusts may profitably supplement liquid sprays in orchards large enough to justify the purchase of both liquid and dust sprayers. The dust applications may be made quickly between liquid applications and thus will tend to lessen the damage from both insects and diseases. It would be a serious mistake for the grower to rely wholly upon dusts. The dormant sprays must consist of a liquid application, and where apple blotch is serious, dusts have not as yet proved nearly as effective as Bordeaux.

SOUR CHERRIES AND AMERICAN PLUMS

Time of Application.	Materials to Use.	For Control of.	Remarks.
(1) Dormant spray. Just before the buds swell in the spring.	Lime-sulphur 14 gal., water to make 100 gal.; or cold or boiled lubricating oil emulsion 3 gal., water to make 100 gal.	San Jose scale, cherry scale.	When scale is absent, the dormant spray may be omitted.
(2) First summer spray. Just before the blossom buds open.	Lime-sulphur 3 gal., arsenate of lead 2 lb., water to make 100 gal.; or 3-4-50 Bordeaux 100 gal., arsenate of lead 2 lb.	Curculio, brown rot, leaf spot.	Lime-sulphur does less injury and gives a much better finish to the appearance of the fruit and foliage.
(3) Second summer spray. As the husks or calyces fall.	Lime-sulphur 3 gal., arsenate of lead 2 lb., water to make 100 gal.; or 3-4-50 Bordeaux 100 gal., arsenate of lead 2 lb.	Curculio, brown rot, leaf spot.	Bordeaux may give better control of leaf spot during wet seasons.
(4) Third summer spray. About 10 to 12 days after No. 3.	Lime-sulphur 3 gal., arsenate of lead 2 lb., water to make 100 gal.; or 3-4-50 Bordeaux 100 gal., arsenate of lead 2 lb.	Curculio, brown rot, leaf spot.	A less number or additional sprays may be required depending on the severity of the diseases, curculio, and the weather.
(5) Fourth summer spray. Soon after harvesting the fruit.	Lime-sulphur 3 gal., arsenate of lead 2 lb., water to make 100 gal.; or 3-4-50 Bordeaux 100 gal., arsenate of lead 2 lb.	Leaf spot, leaf eating insects.	For Japanese plums like Burbank, Abundance, Chebot, etc., use peach spray in same proportions, as it is less likely to do injury to fruit and foliage.

PEACHES

Time of Application.	Materials to Use.	For Control of.	Remarks.
(1) Dormant spray. Any time after the leaves drop in the fall and before the buds swell in the spring.	Lime-sulphur 14 gal., water to make 100 gal.; or cold or boiled lubricating oil emulsion 3 gal., 3-4-50 Bordeaux to make 100 gal.	San Jose scale, other scale insects, peach leaf curl.	When scale is absent, use 3-4-50 Bordeaux or lime-sulphur 7 gal., water to make 100 gal., for control of peach leaf curl. Apply before buds start.
(2) First summer spray. As the husks or calyces fall, usually about 4 to 7 days after the bloom drops.	Dry-mix sulphur lime 25 lb., arsenate of lead 2 lb., water 100 gal.	Curculio, brown rot.	Where brown rot is not serious, very good results may be had from spray made from 8 lb. lime and 2 lb. arsenate of lead to 100 gal. water.
(3) Second summer spray. About 10 to 12 days after No. 2.	Dry-mix sulphur lime 25 lb., arsenate of lead 2 lb., water 100 gal.	Scab, brown rot, curculio.	Dry-mix sulphur lime is generally the most satisfactory spray for peaches.
(4) Third summer spray. About 10 to 12 days after No. 3.	Dry-mix sulphur lime 25 lb., arsenate of lead 2 lb., water 100 gal.	Scab, brown rot, curculio.	Where scale and leaf curl are absent, sprays Nos. 2 and 3 will often be sufficient for early peaches. Varieties like Elberta, Heath Cling and Krummel may require two or three additional sprays made at intervals of about 10 to 12 days.
(5) Fourth summer spray. About 10 to 12 days after No. 4.	Dry-mix sulphur lime 25 lb., arsenate of lead 2 lb., water 100 gal.	Scab, brown rot, curculio.	During rainy seasons additional sprays may be required.

DUSTING PROGRAM FOR PEACHES, CHERRIES AND PLUMS

Time of Application.	Materials to Use.	For Control of.	Remarks.
(1) Dormant spray. Dust is not advised. Use liquid sprays suggested.	Lime-sulphur 14 gal., water to make 100 gal.; or cold or boiled lubricating oil emulsion 3 gal., 3-4-50 Bordeaux to make 100 gal.	San Jose scale, cherry scale, other scale insects, peach leaf curl.	When scale is absent use 3-4-50 Bordeaux, or lime-sulphur 7 gal., water to make 100 gal., for peach leaf curl. Apply before growth starts.
(2) First summer spray. When about 75% of the petals have fallen.	95-5 sulphur-lead arsenate dust.	Curculio, brown rot, cherry leaf spot.	Only the finely ground and specially prepared sulphur and arsenicals are satisfactory as dust sprays.
(3) Second summer spray. When calyces or shucks are shedding or about 4 to 7 days after the blossoms drop.	95-5 sulphur-lead arsenate dust.	Curculio, brown rot, peach scab, cherry leaf spot.	Commercial concerns handle machines, equipment and materials suitable for applying dust sprays.
Special spray. About 7 days after No. 3.	95-5 sulphur-lead arsenate dust.	Curculio, brown rot, peach scab, cherry leaf spot.	This spray is not required unless curculio is serious.
(4) Third summer spray. About 10 to 12 days after No. 3.	95-5 sulphur-lead arsenate dust.	Curculio, brown rot, peach scab, cherry leaf spot.	Dust sprays are in general more satisfactory for stone fruits than for apples. This is particularly true for the peach.
(5) Fourth summer spray. About 10 to 12 days after No. 4.	95-5 sulphur-lead arsenate dust.	Curculio, brown rot, peach scab, cherry leaf spot.	Additional dust sprays at intervals of 10 to 12 days may be needed until within about 3 weeks of harvest.

GRAPES

Time of Application.	Materials to Use.	For Control of.	Remarks.
(1) Dormant spray. A few weeks before growth starts in the spring.	Lime-sulphur 14 gal., water to make 100 gal.	Grape scale, San Jose scale, anthracnose, black rot.	If scale is absent, use 4-4-50 Bordeaux for anthracnose and black rot.
Special bud spray. As buds are swelling.	Arsenate of lead 6 lb., lime 8 lb., water 100 gal.	Grape flea beetle.	If flea beetles are serious, repeat the spray in 5 to 7 days.
(2) First summer spray. When shoots are showing second or third leaf.	3-4-50 Bordeaux 100 gal., arsenate of lead 6 lb.	Black rot, anthracnose, flea beetle, rose chafer, curculio.	Lime-sulphur solution is not used as a spray for grapes on account of the injury it may do to fruit and foliage.
(3) Second summer spray. Just before blossoms open.	3-4-50 Bordeaux 100 gal., arsenate of lead 4 lb.	Black rot, anthracnose, curculio, flea beetle, berry moth, rose chafer.	For grape climbing cut worm, use poison bran mash sowing it broadcast on ground under vines in evening.
(4) Third summer spray. About 10 to 12 days after No. 3, or when the bloom is off.	3-4-50 Bordeaux 100 gal., arsenate of lead 4 lb.	Black rot, anthracnose, downy mildew, powdery mildew, curculio.	Thorough spraying and timely applications are required in successful grape culture.
(5) Fourth summer spray. About 10 to 14 days after No. 4.	3-4-50 Bordeaux 100 gal., arsenate of lead 4 lb.	Black rot, anthracnose, downy mildew, powdery mildew, curculio, grape root worm.	Perhaps more beginners in grape growing fail on account of improper spraying than from all other causes.
(6) Fifth summer spray. About 10 to 14 days after No. 5.	3-4-50 Bordeaux 100 gal., arsenate of lead 4 lb.	Black rot, anthracnose, downy mildew, powdery mildew, curculio, grape root worm.	It is important that spraying be discontinued at 4 to 6 weeks before harvest, otherwise the fruit may be badly stained.
(7) Sixth summer spray. About 10 to 14 days after No. 6.	3-4-50 Bordeaux 100 gal., arsenate of lead 4 lb.	Black rot, anthracnose, downy mildew, powdery mildew, curculio, grape root worm.	In vineyards where diseases and insects are not serious, three or four of the earlier sprays may be sufficient.

BLACKBERRIES, RASPBERRIES AND DEWBERRIES

Time of Application.	Materials to Use.	For Control of.	Remarks.
(1) Dormant spray. Just before growth starts in early spring.	Lime-sulphur 14 gal., water to make 100 gal.	Scale insects.	Canes should be tied up to trellis before making application.
(2) First summer spray. When new shoots are 8 to 10 in. long.	Lime-sulphur 2½ gal., arsenate of lead 2 lb., water to make 100 gal.; or 3-4-50 Bordeaux 100 gal., arsenate of lead 2 lb.	Anthracnose, leaf roller, sawfly.	Arsenate of lead may be omitted when insects are not present.
(3) Second summer spray. Just before the blossoms open.	Lime-sulphur 2½ gal., arsenate of lead 2 lb., water to make 100 gal.; or 3-4-50 Bordeaux 100 gal., arsenate of lead 2 lb.	Anthracnose, leaf roller, sawfly.	Arsenate of lead may be omitted when insects are not present.
(4) Third summer spray. Immediately after harvest.	Lime-sulphur 2½ gal., arsenate of lead 2 lb., water to make 100 gal.; or 3-4-50 Bordeaux 100 gal., arsenate of lead 2 lb.	Anthracnose, leaf roller, sawfly.	Apply spray after the removal of the old canes.

STRAWBERRIES

Time of Application.	Materials to Use.	For Control of.	Remarks.
(1) First summer spray. Soon after growth starts in spring.	3-4-50 Bordeaux 100 gal., arsenate of lead 4 lb.	Crown borer, leaf roller, slugs, weevils, leaf spot, flea beetle.	Fields started with healthy plants and fruited no longer than 2 years are not likely to need spraying.
(2) Second summer spray. About 10 to 12 days after No. 1.	3-4-50 Bordeaux 100 gal., arsenate of lead 4 lb.	Leaf roller, slugs, other foliage-eating insects, leaf spot, mildew.	Important that spray be applied thoroughly.
(3) Third summer spray. Just as plants begin to bloom.	3-4-50 Bordeaux 100 gal., arsenate of lead 4 lb.	Leaf roller, slugs, other foliage-eating insects, leaf spot, mildew.	Where insects and diseases are not serious spray may be omitted.
(4) Fourth summer spray. After renewal following the harvest.	3-4-50 Bordeaux 100 gal., arsenate of lead 4 lb.	Leaf roller, slugs, other foliage-eating insects, leaf spot, mildew.	Important spray where insects and diseases are serious.

CURRANTS AND GOOSEBERRIES

Time of Application.	Materials to Use.	For Control of.	Remarks.
(1) Dormant spray. While dormant in fall, winter or spring.	Any of the standard dormant or scale sprays suggested in tables for other fruits.	Scale insects.	When scale is absent, dormant spray may be omitted.
(2) First summer spray. When leaves are unfolding.	Lime-sulphur 2½ gal., arsenate of lead 2 lb., water to make 100 gal.; or 3-4-50 Bordeaux 100 gal., arsenate of lead 2 lb.	Leaf spot, mildew, anthracnose.	Where diseases are serious, Bordeaux is suggested instead of lime-sulphur.
(3) Second summer spray. Soon after fruit is set.	Lime-sulphur 2½ gal., arsenate of lead 2 lb., water to make 100 gal.; or 3-4-50 Bordeaux 100 gal., arsenate of lead 2 lb	Leaf spot, mildew, aphids, currant worms.	If aphids are serious, add nicotine sulphate 1 pint to 100 gal.
(4) Third summer spray. About 10 to 14 days after No. 3.	Lime-sulphur 2½ gal., arsenate of lead 2 lb., water to make 100 gal.; or 3-4-50 Bordeaux 100 gal., arsenate of lead 2 lb.	Leaf spot, mildew, aphids, currant worms.	If diseases are serious, use Bordeaux 3-4-50.
(5) Fourth summer spray. After fruit is picked.	Lime-sulphur 2½ gal., arsenate of lead 2 lb., water to make 100 gal.; or 3-4-50 Bordeaux 100 gal., arsenate of lead 2 lb.	Leaf spot, anthracnose, leaf-eating insects.	This spray is not needed unless diseases and insects are serious.

LUBRICATING OIL EMULSIONS

Oil emulsions have been used in Missouri for 5 years as dormant sprays for San Jose scale control. They are not recommended as foliage or fruit sprays. When directions for preparing, diluting and applying oil emulsions as a dormant spray are strictly followed, we believe that they are effective in controlling scale. Two per cent of oil is the strength recommended as a dormant spray. Remember also that free oil, which may rise out of an improper emulsion, or from the diluted spray mixture, is liable to cause injury to fruit trees. If free oil does rise, the emulsion is not safe to use. Consult Missouri Experiment Station Circular 103 and Bulletin 216 on preparing oil emulsions. Do not spray free oil on trees. For best results, a good emulsion must be maintained at all times. Lubricating oil emulsion is not fool-proof, but, if properly prepared and applied when weather conditions are favorable for dormant spraying, experience to date shows it to be safe. This also applies to the commercial oil emulsions and miscible oils on the market.

POINTS TO BE REMEMBERED

The lubricating oil emulsions are not recommended as fungicides. There is no evidence that they have any fungicidal value. When mixed with Bordeaux 3-4-50, however, the combination spray becomes a fungicide as well as an insecticide.

1. For the effective control of scale, liquid lime-sulphur, the lubricating oil emulsions, or miscible oils may be used. If there is any slight advantage in the matter of scale control, it is on the side of the oils.
2. From the standpoint of scale alone, the lubricating oil emulsion sprays are the cheaper.
3. From the point of view of possible injury to the fruit trees, lime-sulphur has a decided advantage, as it has never caused injury when applied on dormant trees. However, the oil emulsions are being used extensively for dormant sprays, and if the emulsions are properly prepared and diluted, evidence to date indicates that they can be safely used on dormant trees.
4. Use Bordeaux 3-4-50 with every tank of engine oil-soap emulsion. Stock emulsions in which free oil has separated out and come to the surface, due to freezing or any other cause, should not be used. Do not use a dilute spray mixture in which free oil has separated out and come to the surface of the tank. Stir all stock emulsions before measuring out for use. If you make your own emulsions, follow directions carefully, especially instructions to use a pump giving good pressure. The pressure given by a hand pump can usually be increased by decreasing the size of the opening of the nozzle.
5. Careful experiments and observations in Missouri have shown that San Jose scale can be effectively controlled with lime-sulphur, lubricating oil emulsions and proprietary miscible oils. A very thorough application is necessary and each spray must be used at the proper dilution. As many growers have failed to control scale with the oil sprays as with the lime-sulphur spray. It is not, therefore, so much a matter of which spray to use as it is of thorough spraying at the right dilution. One good dormant application each year should keep the scale well under control and prevent injury to the fruit and trees.

GENERAL REMARKS

Arsenate of Lead—The directions in these schedules are based upon powdered arsenate of lead; if the paste form is used, double the amount.

Lime-Sulphur—The directions in these schedules are based upon the use of lime-sulphur concentrate testing 33 to 34 degrees Baume.

Oil Sprays for Deciduous Fruits

By W. P. Flint
Illinois Natural History Survey

SINCE about 1920, oil sprays have been used more and more each year in spraying deciduous fruit trees. In many sections, the oil sprays have almost completely supplanted lime-sulphur as a dormant spray, and there are some indications that they may prove of considerable value during the growing season.

In treating the matter of oil sprays for deciduous fruit trees, we must consider them from two standpoints: that of the sprays to be used for dormant applications and the sprays which may be safely used in summer. These two distinct groups of sprays should be kept in mind, as there is always danger to foliage and fruit if certain types of dormant oil sprays are applied in summer.

Dormant Sprays

Dormant oil sprays may be still further divided into three general classes, and if the orchardist is to obtain the best results, it is important that he be able to distinguish between these different classes of sprays and use the one best suited for the purpose for which he is to use it.

Home-Made Oil Emulsions.—The first class of dormant oil sprays are the so-called home-made oil emulsions, or soap-oil emulsions. These consist of a true emulsion made by combining heated oil, soap and water by pumping. They are the type most commonly used by orchardists who make their own oil sprays. A standard formula for these emulsions consists of boiling together one gallon of light grade lubricating oil of the following grade:

Specific gravity—0.87 to 0.93 at 20 degrees Centigrade.

Volatility—Not above two per cent at 110 degrees Centigrade for four hours (Saybolt test).

Viscosity—90 to 250 seconds at 100 degrees Fahrenheit (Saybolt test).

one quart of water, and one and one-half to two pounds of 40 per cent potash fish-oil or vegetable-oil soap (the amount of soap will depend on the hardness of the water). The soap, oil and water are brought to a boil and then pumped together until a stable emulsion is formed. The resulting stock emulsion is about the consistency of very heavy cream, and if properly made and stored in tight barrels, will keep for a long period. It will freeze at low temperatures, but if allowed to thaw without stirring or jarring, will usually not be injured.

This emulsion spray is usually diluted at the rate of three gallons of stock emulsion in 100 gallons of water for dormant spraying for San Jose scale, or for very heavy infestations at the rate of four gallons in 100 gallons of water.

Where orchards have been injured by the fruit tree leaf roller, this material should be used at the rate of 10 gallons in 100 gallons of water. This emulsion, thoroughly applied, will kill the eggs of the fruit tree leaf roller, as well as any scale that may be on the trees. Extensive applications of this emulsion at dilutions of 12 gallons per 100 gallons of water in western Illinois districts caused no injury to the trees, even though the applications were made rather late in the spring when the buds were showing tip green.

There are some variations in this formula, but the one given will make a very good emulsion, and at the recommended strength will give almost complete control of San Jose scale. This type of emulsion has the advantage of being cheap, the materials costing less than 20 cents per gallon. At the present time there are many large orchardists who have fitted up plants for making this type of emulsion and in addition to making enough for their own needs, they have arranged to supply smaller growers in their vicinity as well. Emulsions of this type can generally be bought for from 20 to 25 cents per gallon or more in small quantities. If used at the rate of four gallons of the stock emulsion in 100 gallons, it will kill from 96 to 98 per cent of all aphids hit. Forty per cent nicotine sulphate can be used with this emulsion. It can be diluted one part to 2000 of the dilute emulsion and still give a very good kill of aphids.

Miscible Oil Sprays.—The second class of dormant oil sprays are the so-called miscible oil sprays. In this class of sprays, an emulsifying agent is combined with the oil, but a true emulsion is not formed until this stock mixture is diluted with water. There are a number of good commercial dormant oil sprays in this general class. These sprays have the following advantages:

They contain a high percentage of oil in proportion to the bulk of the stock material.

They are not apt to be frozen at temperatures such as are usually encountered in apple districts of the Midwest, and in most cases are not injured by freezing.

If properly made, they will emulsify in nearly any water, except perhaps some of the very highly alkaline.

If properly stored, they can be kept from one season to another.

Many of these oils used at the dilutions recommended by the manufacturers have been found to be excellent scale killers.

Miscible oils can be made at home without great difficulty, but this type of oil spray has never proved very popular as a home-made material.

Emulsions Containing Calcium Caseinate or Other Emulsifying Agents.—The third class of oil emulsions in common use are those made with calcium caseinate, bentonite, kaolin, gum ghatti and a number of others. In making this class of emulsions, the emulsifying agents, having in some cases been soaked in water, are very thoroughly agitated with oil and a small amount of water. The amount of emulsifier and water will depend upon the kind of emulsifier used. Probably the most common home-made emulsion of this class is that made with calcium caseinate. A common formula for this emulsion is to pump together two gallons of lubricating oil with one gallon of water, in which has been dissolved four ounces of calcium caseinate. The resulting emulsion contains approximately 66 per cent oil and should be used for San Jose scale dormant spray at the rate of three or four gallons in 100 gallons of water. This calcium caseinate emulsion will separate if allowed to stand for any length of time, and if made at home, care should be taken that the stock solution is in the proper state of emulsion when it is diluted.

Other emulsions of this type made with certain colloidal earths, such as kaolin, Fullers' earth or bentonite, will form much more stable emulsions. The same is true of the emulsions where some of the gums are used as emulsifying agents. Some of these are very stable and will remain in a good state of emulsion over a long period. Home-made emulsions of this type are usually injured by freezing, and the same is true of this type of commercial emulsion.

There are several other kinds of oil emulsions, but none of them has come into general use, mainly because of certain drawbacks, and the three mentioned are those which have been found best suited for dormant sprays of deciduous fruits.

Advantages and Disadvantages of Dormant Oil Sprays

Some of the advantages and disadvantages of the three classes of emulsions may be briefly given as follows:

The home-made soap-oil emulsions are cheap. If properly made and diluted, they are very effective scale killers. Where so made and diluted, they are relatively non-injurious to trees This type of emulsion can be combined with small amounts of nicotine sulphate for the aphis spray. They have, in common with the second class, a rather high wetting ability which makes these first two classes more effective as aphis sprays. Emulsions of these first two classes cannot, unless specially treated, be used with lime-sulphur, but may be used in most cases with Bordeaux mixture and in some cases with copper sulphate.

The second class, or miscible oil emulsions, do not freeze and can be kept indefinitely if properly stored. They can be mixed with nearly any kind of water.

The third class, using the chemically inert emulsifying agents, have a somewhat lower wetting ability. They can be diluted readily with nearly any kind of water. Unless special care is used in their preparation, they may be injured by freezing. They can be combined more readily with other spray materials and can be used with lime-sulphur if such a combination is desired, as well as with Bordeaux mixture, or under some conditions, with copper sulphate

Summer Oil Sprays

During the growing season, when trees are in foliage, they are much more subject to injury from oil sprays than is the case when they are in the dormant stage. Certain types of oils which are safe to use in dormant spraying cannot be safely used in summer applications. The so-called unsaturated or straw oils are usually dangerous to use in summer sprays. The so-called refined or white oils are much safer. Also, in general, the summer oil sprays should be made with chemically inert emulsifying agents, or falling in the third class of those just mentioned. Soap-oil emulsions, while they may be used in summer spraying, under certain conditions are quite likely to cause burning of foliage. The use of oils as summer sprays is still somewhat in the experimental stage. It has been shown by several workers that certain types of oil emulsions, both home-made and commercial, are quite effective in killing the eggs of the codling moth. Better than 90 per cent kill of eggs was obtained in many experiments. There is also a fairly good kill of young codling moth larvae that are actually wet by these sprays. Experimental work in the central states has not shown that this class of sprays can be depended upon for a satisfactory protection from codling moth if used alone throughout the season. When combined with arsenate of lead, there is a tendency for the spray residue to stick more persistently than where such a combination is not used. Where

(*Concluded on page* 33)

Spray Calendar: Shenandoah–Cumberland Region

The apple spray program given below was prepared jointly by representatives of the Agricultural Experiment Stations and Extension Departments of the states of Virginia, West Virginia, Maryland, Ohio and Pennsylvania.

The schedule is intended primarily as a general guide to growers of the district. In each state, the orchardists are advised to consult also the spray calendars issued by their own extension departments and to follow their recommendations when the conditions are at all unusual. The apple calendar was sent to us by Prof. L. M. Peairs, entomologist of the West Virginia Agricultural Experiment Station.

The spray calendars for the other fruits were prepared by the Departments of Horticulture, Plant Pathology and Entomology of the Virginia Polytechnic Institute and were furnished to us by Prof. F. A. Motz, extension horticulturist. While these recommendations were prepared primarily from the standpoint of Virginia conditions, it is believed that they will apply also to most other sections of the district. Growers in the states other than Virginia are advised to consult the recommendations of the extension departments of their own states when conditions are at all abnormal.

APPLES

Time of Application.	Materials to Use.	For Control of.
Dormant. Late winter or early spring when temperature is well above freezing.	Oil emulsion 4½ gal. (see General Remarks), water to make 100 gal.; or tested proprietary oils. This application is usually unnecessary.	Scales and European red mites.
(1) Delayed dormant. Begin when blossom buds first show green and complete before leaves have extended ½ in.	Lime-sulphur 12½ gal., water to make 100 gal.; or dry lime-sulphur 30 lb., water 100 gal.; or engine oil emulsion 4½ gal., water to make 100 gal.; or other oils known to be safe. For aphids add 1 pint nicotine sulphate to 100 gal.	Scales, aphids, European red mite. Note—Oils must be used to control the red mite.
(2) Pre-blossom. When cluster buds begin to separate, or as announced by the Spray Service.	Lime-sulphur 2½ gal., arsenate of lead 3 lb., water to make 100 gal.; or dry lime-sulphur 7 lb., arsenate of lead 3 lb., water 100 gal. (Virginia omits arsenate except for curculio.)	Scab, leaf spot (frog-eye), mildew, curculio, canker worms, bud moth and other chewing insects.
(3) Petal-fall. When most of the petals have fallen.	Lime-sulphur 2½ gal., arsenate of lead 3 lb., nicotine sulphate 1 pint, water to make 100 gal.; or dry lime-sulphur 6 lb., arsenate of lead 3 lb., nicotine sulphate 1 pint, water 100 gal.	Scab, leaf spot, mildew, codling moth, curculio, red bug, and other chewing insects.
(4) Three-weeks. About 3 weeks after petal-fall spray. Date in W. Va. to be announced by the Spray Service.	Same as for petal-fall spray, except that Bordeaux may be advised by the Spray Service in place of lime-sulphur. Lime-sulphur must not be applied in bright sunshine when temperature is above 85 degrees.	Codling moth, curculio, scab, Brooks' spot, blotch, leaf spot.
(5) Five-weeks. About 5 weeks after petal-fall spray. Date in W. Va. to be announced by the Spray Service.		Codling moth, curculio, scab, Brooks' spot, blotch, leaf spot.
(6) Seven-weeks. About 7 weeks after petal-fall spray. Date in W. Va. to be announced by the Spray Service.		Codling moth, curculio, scab, Brooks' spot, blotch, leaf spot.
(7) Ten-weeks. Not recommended in the greater part of the area covered.		Codling moth, scab, sooty blotch, black rot, bitter rot, late caterpillars.
(8) Special blotch sprays.	Where blotch is serious, susceptible varieties should be sprayed with 2-4-50 Bordeaux at dates to be announced by the spray service of the various states.	

PEACHES

Time of Application.	Materials to Use.	For Control of.
(1) Dormant season (before buds have commenced to swell), February or early March.	Lime-sulphur 12 gal., water to make 100 gal.	Scale, leaf curl.
(2) Immediately after the petals drop.	Arsenate of lead 2 lb., freshly slaked lime 6 lb., water 100 gal.	Curculio.
(3 One week after No. 2.	Arsenate of lead 2 lb., freshly slaked lime 6 lb., water 100 gal.	Curculio.
(4) Three weeks after No. 3.	Arsenate of lead 2 lb., self-boiled lime-sulphur or dry-mix 100 gal.	Curculio, scab.
(5) One month before fruit ripens.	Self-boiled lime-sulphur or dry-mix.	Scab, brown rot.
(6) For late varieties only; 3 weeks after No. 5.	Self-boiled lime-sulphur or dry-mix.	Brown rot.

In the northern part of Virginia and in orchards which are damaged from early infection of brown rot, resulting in blighting of the blossoms and drying up and dropping of the small fruit, apply same materials as in spray No. 4 when pink begins to show in the bud. Early infection of brown rot is not prevalent generally over the state, but it occurs in parts of northern Virginia, particularly in Loudoun county. Unless blossom blight has been prevalent, follow the schedule as recommended in calendar above. No. 1 must be applied while the trees are absolutely dormant and before the bud scales begin to separate, if leaf curl is to be controlled, and the pink spray must go on before the petal spray.

If rose chafer should become serious, spray with arsenate of lead 8 lb., water 100 gal., to which 2 gal. of molasses are added. Application should be made when the bugs appear. Caution—This spray should not be used unless absolutely necessary, as severe burning may follow.

PLUMS

Time of Application.	Materials to Use.	For Control of.
(1) Dormant season.	Lime-sulphur 12 gal., water to make 100 gal.	Scale and general clean-up.
(2) As soon as petals fall.	Lime-sulphur 3 gal., arsenate of lead 2 lb., water to make 100 gal.	Curculio, leaf spot.
(3) One week after No. 2.	Lime-sulphur 3 gal., arsenate of lead 2 lb., water to make 100 gal.	Curculio, leaf spot.
(4) Three weeks after No. 3.	Lime-sulphur 3 gal., arsenate of lead 2 lb., water to make 100 gal.	Curculio, leaf spot.
(5) One month before fruit ripens.	Self-boiled lime-sulphur.	Brown rot and other fungous diseases.

CHERRIES

Time of Application.	Materials to Use.	For Control of.
(1) Dormant season.	Lime-sulphur 12 gal., water to make 100 gal.	Scale.
(2) Immediately after petals fall.	For sour cherries, use lime-sulphur 3 gal., arsenate of lead 2 lb., water to make 100 gal. For sweet cherries, use lime-sulphur 2½ gal., arsenate of lead 2 lb., water to make 100 gal.	Leaf spot, curculio.
(3) One week after No. 2.	For sour cherries, use lime-sulphur 3 gal., arsenate of lead 2 lb., water to make 100 gal. For sweet cherries, use lime-sulphur 2½ gal., arsenate of lead 2 lb., water to make 100 gal.	Leaf spot, curculio.
(4) Three weeks after No. 3.	For sour cherries, use lime-sulphur 3 gal., arsenate of lead 2 lb., water to make 100 gal. For sweet cherries, use lime-sulphur 2½ gal., arsenate of lead 2 lb., water to make 100 gal.	Leaf spot, curculio, brown rot.
(5) Immediately after fruit is harvested.	For sour cherries, use lime-sulphur 3 gal., water to make 100 gal. For sweet cherries, use lime-sulphur 2½ gal., water to make 100 gal.	Leaf spot.

If rose bug should become serious, apply same treatment as recommended for peaches.

GRAPES

Time of Application.	Materials to Use.	For Control of.
(1) Dormant season.	Lime-sulphur 12 gal., water to make 100 gal.	Scale and general clean-up.
(2) When second or third leaf shows.	4-5-50 Bordeaux.	Anthracnose, bitter rot, black rot, mildew.
(3) Before blossoms open.	4-5-50 Bordeaux.	Anthracnose, bitter rot, black rot, mildew.
(4) After blossoms fall.	4-5-50 Bordeaux.	Anthracnose, bitter rot, black rot, mildew.
(5) Ten to 14 days later.	4-5-50 Bordeaux.	Anthracnose, bitter rot, black rot, mildew.
Thereafter at 2-week intervals until within 2 weeks of harvest time.	4-5-50 Bordeaux.	Anthracnose, bitter rot, black rot, mildew.

Arsenate of lead 4 lb. should be combined with 100 gal. Bordeaux if chewing insects make an appearance.

Burgundy mixture may be substituted for Bordeaux in the last spray in order to prevent discoloring of the fruit. The following formula is suggested:

Caustic soda	5 lb.
Copper sulphate	4 lb.
Water	50 gal.

Prepare and apply same as Bordeaux.

RASPBERRIES AND BLACKBERRIES

Anthracnose causes cankers on the canes of the raspberry and blackberry. It is the most important disease of the bush fruits in Virginia and can be effectively controlled by the application of two lime-sulphur sprays according to the following calendar. The addition of a casein spreader at the rate of 1 lb. to 100 gal. of spray material is necessary to secure control.

Time of Application.	Materials to Use.	For Control of.
(1) In spring just after growth begins.[1]	Lime-sulphur 11 gal., water to make 100 gal.	Anthracnose.
(2) One week before bloom.	Lime-sulphur 2 gal., water to make 100 gal.	Anthracnose.

[1]Spray No. 1 should be applied after growth begins but not after the leaves have reached ½ in. in length.

STRAWBERRIES

Time of Application.	Materials to Use.	For Control of.
(1) When growth begins.	4-5-50 Bordeaux.	Leaf spot.
(2) Before blossoming.	4-5-50 Bordeaux.	Leaf spot.
(3) Just after blossoming.	4-5-50 Bordeaux.	Leaf spot.
(4) After leaves have been mowed and burned.	Arsenate of lead 2 lb., 4-5-50 Bordeaux 100 gal.	Leaf spot, flea beetle.

Should leaf roller appear, or if it has been prevalent, add lead arsenate at rate recommended in No. 4 spray in each application.

GENERAL REMARKS

Arsenate of Lead—The directions in these schedules are based upon powdered arsenate of lead; if the paste form is used, double the amount.

Lime-Sulphur—The directions in these schedules are based upon the use of lime-sulphur concentrate testing 32 degrees Baume.

Oil Emulsion—The engine oil emulsion recommended in the apple schedule is that made according to Missouri formula No. 2. In making the stock solution according to this formula, use engine oil 2 gal., water 1 gal., and Kayso (calcium caseinate) ¼ lb. First thin the Kayso with water, working it into a paste and adding the water gradually. Then add the oil. Agitate the material vigorously by pumping it through a hand sprayer until it is thoroughly emulsified. The resulting material is called the stock solution and should be diluted as indicated.

Self-Boiled Lime-Sulphur—For making 100 gal. self-boiled lime-sulphur, use 16 lb. fresh lump lime, 16 lb. ground sulphur, water to make 100 gal. Use only the best grade of lime. Place the lime in a barrel or vat and add a bucket of water to start slaking. When slaking is well started, sift in the sulphur and add more water gradually. Stir the lime and sulphur vigorously to prevent caking. Add water as needed to prevent drying or burning, but do not flush the mixture and cool it unnecessarily.

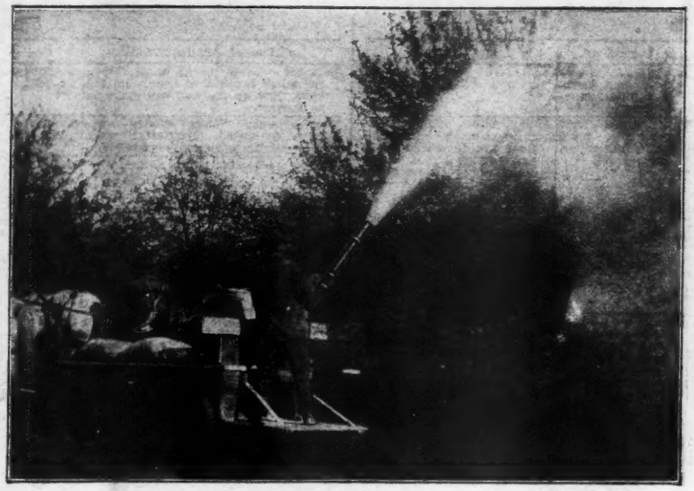
When the slaking is practically finished, wash the mixture immediately through a strainer to eliminate lumps. Add sufficient water to make 100 gal. Keep the material thoroughly agitated and apply in the freshest condition possible.

Cost Analysis of a Modern Spray Schedule

By Malcolm Hitchings

DURING 1926, the author kept a cost analysis of a complete schedule of spraying and dusting on a plot of six acres of 15-year-old apple trees. On this plot, there were 200 McIntosh and 200 Rome trees, all strong growing and vigorous. A complete schedule was used on this orchard due to the fact that it was deemed wise to make sure that all danger of injury was removed from this particular block, because there was every indication of a fair McIntosh crop of excellent quality and a good crop of Romes in sight, and because of the nearness to the main buildings of the farm, coupled with the fact that it has proved in the past to be one of the most profitable plots of its size known.

For equipment, a Bean Senior spray rig and the large size Niagara duster were used. Three men were used at all times on the spray rig—two of them spraying and one driving. On the duster, three men were used on the first dusting and two thereafter. Applications were made in delayed dormant, pre-pink, pink and calyx periods and at such other times as it was deemed wise in order to have sufficient coverage to be protected from scab injury and insect danger. No charge was made for depreciation on the rigs, teams or other equipment. Cost was kept merely on materials used for spraying and labor of application, including time of hitching and unhitching teams and filling of rigs and other work incidental to actual operations of spraying or dusting. Readers in studying the charts presented should bear in mind that this was by no means an experiment or experimental data. It was real practical experience on a large commercial orchard located in central New York and was one plot of many which are cared for by the same organization. The author was one of the crew with the machines at all times and knowledge is first-handed.



Putting on the pink application with a modern dusting machine

In reading the production record (Schedule C), it must be borne in mind that this orchard has been producing good crops for the last 10 years and that in 1925 it bore 500 barrels of McIntosh and 200 barrels of Rome (picked fruit), so the year 1926 was really a rest year for the plot.

As for results and benefits received from the above schedule of spraying, it must be remembered that the 1926 season was fairly free from scab danger or injury. This orchard showed as near as could be ascertained 100 per cent control of scab. At least no scabby apples were seen when the apples were packed, and as the McIntosh were graded by hand and the Romes were closely inspected as they ran over the grader, it was next to impossible to miss such a phenomenon as a scab spot. The codling moth injury was very negligible and was confined to a few late hatch side stings. There was very little red bug or aphis injury. There was slight injury from the lesser fruit worm which came on in August, and because all were not killed by the special apple maggot dusting on July 28. No work of the apple maggot was discernible. It was estimated by the author and the other three persons who graded with him that the McIntosh packed out 95 per cent A grade, over half of which ran two and three-fourths inches and up in size. Those that did not meet the grade requirements were mostly too green and were not affected with insect or other injury. About 83 per cent of the Romes ran A grade, with the majority running three inches and up in size. There were very few apples of two and one-fourth inch size in the lot. The under grade apples were mostly too green to meet the grade. The heaviest load of the fruit was produced on the north side of the trees, for some reason unknown to the growers.

Due to the success obtained during the 1926 season, it was not deemed wise to materially alter the spray schedule for 1927. A delayed dormant of Bordeaux-oil emulsion was put on partly as a protection against red mite, which was seen in the orchard the previous year, and particularly against aphis. A second application of Bordeaux-lime-lead arsenate and slightly increased use of dust, together with two full applications of nicotine spray and a nearly complete application of nicotine dust, were the main differences. Eleven applications and a half of a twelfth were made as follows: delayed dormant, pre-pink, pink, late pink, calyx, 10-day, 20-day and such other special aphis and scab control applications as weather and conditions demanded. A cost record was not kept for this season. Timing of applications was watched closely. Romes and McIntosh were sprayed on different dates to take care of the difference in unfolding of buds. It is believed that plenty of material early and the decision to dust the McIntosh in full bloom with sulphur dust prevented a serious scab infection. A late application of dry-mix on Romes stopped a late tip leaf scab infection from spreading to the fruits. Aphids were held in check so well that their work was not apparent at harvest.

As regards production, it was very satisfactory this season. McIntosh yielded approximately 500 barrels of picked fruit and 25 barrels of drops. Romes yielded 519 barrels of picked fruit and 20 barrels of drops. This made a total of well over 1000 barrels of picked fruit, or an average of 166⅔ barrels per acre and two and one-half barrels per tree. No trees in the plot were overloaded and all are in fine condition for a crop in 1928. The McIntosh packed out just about 95 per cent of U. S. No. 1, and the Rome 85 per cent U. S. No. 1, both with fancy included. Defective apples or off-grade apples were thrown out principally for poor color or injury from late feeding fruit worms. Scab was again a rarity. Two McIntosh trees on the border of this little orchard, both of the same age as the others, were left unsprayed all season just to see if all this work and expense did pay. Some dust and spray drifted on these trees, of course. Early in the season the defective fruits did not show up badly. Later, many of the badly deformed scabby fruits and wormy ones dropped prematurely. At harvest time, the poorest were left on the trees, and the rest were stored ungraded with the other tree-run fruit from the main block of trees. When graded recently, 33⅓ per cent of the products from these two trees as stored failed to meet U. S. No. 1 requirements as against five per cent for the rest of the crop, which received the complete schedule. In other words, approximately seven times as many off-grade apples were obtained from the unsprayed as from the sprayed trees, including premature drops and fruit left on the trees. How better then can a grower profit than by adding $3 to $5 per barrel to 35 per cent of his crop by thorough spraying? Perhaps an outlay of $75-$100 was made for material and labor on the McIntosh in this plot to get back about $4 per barrel on 35 per cent of a 500-barrel crop, or $700. Good spraying will pay, not one year or

(Concluded on page 21)

SCHEDULE A—STATEMENT OF MATERIALS AND LABOR USED

Date.	Hours. Men.	Hours. Teams.	Lime-sulphur. Gal.	Arsenate of lead. Lb.	Nicotine sulphate. Pt.	No. of gal. 200-tanks.	Super-sulphur dust. Lb.	85-15 sulphur-lead dust.[1] Lb.	Kolotex dust.[2] Lb.	Wettable sulphur. Lb.
May 2	10½	3½	17½	2½[3]	...	2½	...	...	...	...
May 7 and 8	9	3	13½	13½	...	2⅔	...	...	...	...
May 13 and 14	2	1	....	...	...	...	...	...	200	...
May 17	2	1	....	...	...	...	...	...	190	...
May 21 and 22	15	5	....	...	...	3½	...	...	...	112
May 24[4]	6	2	....	...	3¾	⅝	...	...	...	...
May 31	2½	1¼	....	...	...	....	200	...	...	...
June 2[5]	9	3	....	11¾	...	2½	...	...	...	74⅔
June 4 and 10[6]	18	6	....	...	8.025	3½	...	...	...	...
June 5[4]	1½	¾	....	...	...	...	...	...	125	...
June 14	3	1½	....	...	...	...	200	...	...	...
July 28	2	1	....	...	...	...	...	200	...	...
Totals	80½	29	30 5/6	27½	11.275	15⅛	400	200	515	186⅔

[1]85 per cent sulphur and 15 per cent lead dust.
[2]Colloidal lead-sulphur dust.
[3]Lead used on four rows of trees only.
[4]These applications used on Romes only.
[5]This application put on McIntosh only.
[6]Part of orchard sprayed at this time had application on June 4 on part of McIntosh, and rest of orchard received it on June 10.

Applications: May 2, delayed dormant; May 7 and 8, special scab and insect; May 13 and 14, pre-pink; May 17, pink; May 21 and 22, special scab—rainy period; May 24, special aphis on Rome; May 31, special scab after rain the previous night; June 2, calyx on McIntosh; June 4 and 10, special aphis; June 5, calyx on Romes; June 14, special scab before and during rainy period; July 28, special apple maggot application.

SCHEDULE B—STATEMENT OF COST OF LABOR AND MATERIALS, BY APPLICATIONS

Date.	Labor Costs Men.	Teams.	Total.	Cost of material.	Cost of application.
May 2	$5.25	$1.40	$6.65	$ 3.225	$ 9.875
May 7 and 8	4.50	1.20	5.70	4.599	10.299
May 13 and 14	1.00	.40	1.40	16.00	17.40
May 17	1.00	.40	1.40	15.20	16.60
May 21 and 22	7.50	2.00	9.50	5.88	15.38
May 24	3.00	.80	3.80	5.28	9.08
May 31	1.25	.50	1.75	6.50	8.25
June 2	4.50	1.20	5.70	5.89	11.59
June 4 and 10	9.00	2.40	11.40	13.04	24.44
June 5	.75	.30	1.05	10.00	11.05
June 14	1.50	.60	2.10	6.50	8.60
July 28	1.00	.40	1.40	15.60	17.00
Totals	$40.25	$11.60	$51.85	$107.71	$159.564

Cost of Labor: Men, per hour, 50 cents; teams, per hour, 40 cents.

Cost of Materials: Lime-sulphur, per gallon, 16 cents; lead, per pound, 17 cents; super-sulphur, per hundred, $3.25; 85-15, per hundred, $7.80; Kolotex, per hundred, $8; nicotine sulphate, per gallon, $13; wettable sulphur, per hundred, $5.25. Prices are delivered prices in Syracuse, N. Y.

Dilutions of materials used (see Schedule A also): Delayed dormant—lime-sulphur, 7 gallons; water, 200 gallons. All other sprays with lime-sulphur: Lime-sulphur, 5 gallons; water, 200 gallons. Arsenate of lead (all applications where used), 5 pounds; water, 200 gallons. Wettable sulphur (all applications where used), 32 pounds; water, 200 gallons. Nicotine sulphate, 1 quart; water, 200 gallons, except 2½ tanks on June 10 which had nicotine sulphate, 1⅛ quarts; water, 200 gallons.

SCHEDULE C—FRUIT PRODUCTION RECORD

Classification.	Bushels of picked fruit.	Bushels of drops.	Total.
200 McIntosh trees	750	75	825
200 Rome trees	495	45	540
Totals	1245	120	1365
Average per tree—McIntosh	3.75	0.375	4.125
Average per tree—Rome	2.475	0.225	2.7
Average per tree—Both combined	3.1125	0.3	3.4125
Average per acre—McIntosh (3 acres)	250	25	275
Average per acre—Rome (3 acres)	165	15	180
Average per acre—Both (6 acres)	207.5	20	227.5

SCHEDULE D—COST OF SPRAYING PER ACRE, PER TREE AND PER BUSHEL

Classification.	Labor cost.	Material cost.	Total.
Cost per acre (average)	$8.641	$17.951	$26.592
Cost per tree (average)	0.1296	0.2693	0.3989
Cost per bushel (average)	0.0379	0.0788	0.1167

Spray Schedule for New York

Prepared by Entomologists and Plant Pathologists of the New York State Agricultural Experiment Station and the New York State College of Agriculture

APPLES

Time of Application.	Spray Mixtures.	For Control of.	Dust Mixtures.
Delayed dormant. When leaves of blossom buds are out ¼ to ½ in.	Lime-sulphur 2½ gal.[1], arsenate of lead 2½ lb., nicotine sulphate ¾ pint, water to make 100 gal.	Scab, scale, blister mite, bud moth, leaf roller, casebearers, aphids.	No satisfactory dust for scale or blister mite.
Pre-blossom. Two applications between delayed dormant and calyx periods are necessary in a rainy season.	Lime-sulphur 2½ gal. arsenate of lead 2½ lb., water to make 100 gal.	Scab, green fruit worms, bud moth, leaf roller, casebearers.	Apply 90-10 sulphur-lead arsenate dust.[2] If conditions are favorable for a bad outbreak of scab, spray as much as possible, using dust to complete the operation on time. In combating rosy aphis with dust mixtures the most promising means of control is a heavy application of a mixture containing not less than 2% nicotine as blossom buds begin to show pink.
Calyx. When the last of the petals are falling.	Lime-sulphur 2½ gal., arsenate of lead 2½ lb., nicotine sulphate 1 pint, water to make 100 gal.	Scab, codling moth, green fruit worms, bud moth, curculio, lesser apple worm, redbugs.	Apply 90-10 sulphur-lead arsenate dust.[2] For redbugs, use 90-10 dust with 2% nicotine. If conditions are favorable for a destructive outbreak of scab, spray as much of the orchard as possible, using dust in a supplementary capacity.
Later sprays. To be determined by weather conditions and control of scab.	Lime-sulphur 2½ gal. arsenate of lead 2½ lb., water to make 100 gal.	Scab, codling moth, curculio, lesser apple worm, apple maggot.	Later applications with 90-10 sulphur-lead arsenate dust.[2] During prolonged rainy periods it is advisable to make applications of dust at shorter intervals than indicated for spray mixtures.

[1]Use 11 gal. of lime-sulphur when San Jose scale is present.
[2]Copper lime dust may cause russeting, especially at the calyx application. At this time use spray or 90-10 sulphur-lead arsenate dust.
[3]If foliage injury is feared, the most satisfactory alternative for lime-sulphur is the wettable sulphur spray as described below under "General Remarks."

PEACHES

Time of Application.	Spray Mixtures.	For Control of.	Dust Mixtures.
Late fall or early spring, before buds swell.	If scale is abundant, use lime-sulphur 11 gal., water to make 100 gal. If there is no scale, use lime-sulphur 6½ gal., water to make 100 gal.	San Jose scale, leaf curl. Leaf curl.	Dust not advised.
When blossoms show pink.	Sulphur-lime dry mix.	Blossom blight, brown rot.	Apply 95-5 sulphur-lead arsenate dust.
When shucks are falling.	Sulphur-lime dry mix and arsenate of lead 3 lb. in 100 gal.	Brown rot, scab, curculio.	Apply 90-10 sulphur-lead arsenate dust.
Two or 3 weeks after shucks fall.	Sulphur-lime dry mix.	Brown rot, scab.	Apply 95-5 sulphur-lead arsenate dust.
Two to 4 weeks before fruit ripens.	Sulphur-lime dry mix.	Brown rot, scab.	Apply 95-5 sulphur-lead arsenate dust.

Dry mix sulphur-lime is prepared as follows:
Superfine sulphur.....16 lb.
Hydrated lime..... 8 lb. } For 100 gal. water.
Calcium caseinate.... 1 lb.
Mix the materials dry, then add to the water in the spray tank while agitator is running.

CHERRIES

Time of Application.	Spray Mixtures.	For Control of.	Dust Mixtures.
Delayed dormant. When bud scales separate and expose green blossom buds.	(For sweet cherries only.) Lime-sulphur 11 gal., nicotine sulphate ¾ pint, water to make 100 gal.; or nicotine sulphate ¾ pint, soap 5 or 6 lb., water to make 100 gal.	Scale, aphids. Aphids.	No satisfactory dust for scale. Control of aphis by 90-10 sulphur-lead arsenate dust with 2% nicotine not yet demonstrated. Thorough dusting with 2% nicotine dust should reduce number of insects.
Just before blossoms open.	Lime-sulphur 2½ gal. water to make 100 gal.	Brown rot, blossom blight.	Apply 95-5 sulphur-lead arsenate dust.
When petals fall.	Lime-sulphur 2½ gals. (sweet cherries 2 gal.), arsenate of lead 2½ lb., water to make 100 gal.	Leaf spot, brown rot, curculio.	Apply 90-10 sulphur-lead arsenate dust, or if curculio is abundant, 80-20 sulphur-lead arsenate dust.
Ten days after petals fall or when shucks are off.	Lime-sulphur 2½ gal., (sweet cherries 2 gal.), arsenate of lead 2½ lb., water to make 100 gal.	Leaf spot, brown rot, curculio.	Apply 90-10 sulphur-lead arsenate dust, or if curculio is abundant, 80-20 sulphur-lead arsenate dust.
As Early Richmond cherries show red on one side.	Lime-sulphur 2½ gal., (sweet cherries 2 gal.), arsenate of lead 2½ lb., water to make 100 gal.	Maggot, leaf spot, brown rot.	The merits of dusting in controlling fruit flies are not definitely established; if dusting is preferred, apply 90-10 sulphur-lead arsenate dust.
As Montmorency cherries show red on one side.	Lime-sulphur 2½ gal., (sweet cherries 2 gal.), arsenate of lead 2½ lb., water to make 100 gal.	Maggot, leaf spot, brown rot.	The merits of dusting in controlling fruit flies are not definitely established; if dusting is preferred, apply 90-10 sulphur-lead arsenate dust.
After picking.	Lime-sulphur 2½ gal., (sweet cherries 2 gal.), arsenate of lead 1 to 2 lb., water to make 100 gal.	Leaf spot.	Apply 95-5 sulphur-lead arsenate dust.

PEARS

Time of Application.	Materials to Use.	For Control of.
Dormant. Early in the spring when the adult thrips first appear on the buds, just as the bud scales begin to separate.	Miscible oil 5 gal., nicotine sulphate 1 pint, water to make 100 gal.	Thrips.
Cluster bud. When cluster buds have separated (Bartlett); when they begin to separate (Kieffer).	Lime-sulphur 11 gal., water to make 100 gal.	Scale, scab, psylla eggs.
Calyx. Just after petals fall.	Lime 30 to 40 lb., copper sulphate 2 lb.[1], arsenate of lead 2½ lb., nicotine sulphate 1 pint, water to make 100 gal.	Codling moth, psylla nymphs, scab.
About 2 weeks after petals fall.	Lime-nicotine dust (2% nicotine).	Psylla flies.
	For scab susceptible varieties use Bordeaux 3-10-50.	Scab.
Emergency application in summer when psylla become abundant.	Lime 30 to 40 lb., copper sulphate 2 lb., nicotine sulphate 1 pint, water to make 100 gal.	Psylla nymphs, scab.
	Lime-nicotine dust (2% nicotine).	Psylla flies.

[1]The use of lime-sulphur solution at this time is not advised because of the danger of foliage injury. For those who do not wish to use the lime-copper sulphate mixture, the wettable sulphur spray as described under "General Remarks" is recommended. One pint of nicotine sulphate, 2½ lb. arsenate of lead and 32 lb. hydrated lime should be added to each 100 gal. to kill psylla and dry up the honey dew.

PLUMS

Time.	Materials to Use.	For Control of.
While buds are dormant.	Lime-sulphur 11 gal., water to make 100 gal. (all varieties).	Scale.
When shucks are off young fruits.	Lime-sulphur 2 gal., arsenate of lead 2½ lb., water to make 100 gal. (all varieties except Japanese).	Leaf spot, brown rot, curculio.
From 14 to 20 days later.	Lime-sulphur 2 gal., water to make 100 gal. (all varieties except Japanese.)	Leaf spot, brown rot.
Before fruit ripens.	Lime-sulphur 2 gal., water to make 100 gal. (all varieties except Japanese).	Leaf spot, brown rot.

JAPANESE VARIETIES

On Japanese varieties follow the same schedule as to time of spraying. For the application when the buds are dormant, use lime-sulphur 11 gal., water to make 100 gal., as directed above. For subsequent applications, instead of lime-sulphur solution use self-boiled lime-sulphur 8-8-50, lime-sulphur glue mixture, or sulphur dust. When poison is needed in the dust, use 10% dry powdered arsenate of lead and 90% sulphur. Replace the lead with filler when poison is not needed.

GRAPE SPRAY SCHEDULE FOR FINGER LAKES REGIONS

Time of Application.	Materials to Use.	For Control of.
About 1 week before the blossoms open.[1]	4-4-50 Bordeaux.	Black rot, mildew.
As soon as the berries set.	4-4-50 Bordeaux. If larvae of flea beetle are present, add 3 lb. arsenate of lead to 100 gal.	Black rot, mildew, flea beetle.
Two weeks later. Subsequent applications to be determined by weather conditions and the previous control of black rot and mildew.	4-4-50 Bordeaux.	Black rot, mildew.

[1]If black rot has been severe in past years, make an early application when the second or third leaf is showing, using Bordeaux 4-4-50.

Grape leaf hopper may be controlled by very thorough spraying, using the following formula: Bordeaux 4-4-50, nicotine sulphate ½ pint in 50 gal. of water. The application should be made soon after July 4 when the newly hatched pymphs are on the leaves. An upturned nozzle must be used and care taken to hit the insects. Unless the leaf hoppers are extremely abundant, a special spray for this insect is not likely to be profitable.

GRAPE SPRAY SCHEDULE FOR CHAUTAUQUA GRAPE REGION

Time of Application.	Materials to Use.	For Control of.
Just as soon as the fruit has set. Make special effort to place spray on the clusters.	Arsenate of lead 3 lb., resin fish-oil soap 3 lb., 4-4-50 Bordeaux 100 gal.	Berry moth, powdery mildew.
This is a special berry moth spray and can be omitted if the pest is not present.		
When the root worm beetles first appear in numbers.	Arsenate of lead 3 lb., resin fish-oil soap 3 lb., 4-4-50 Bordeaux 100 gal.	Root worm, berry moth, powdery mildew.
Ten days to 2 weeks later.	Arsenate of lead 3 lb., resin fish-oil soap 3 lb., 4-4-50 Bordeaux 100 gal.	Root worm, berry moth, powdery mildew.
When the maximum number of leaf-hopper nymphs are present, usually between July 12 and 20.	Nicotine sulphate ¾ pint, resin fish-oil soap 3 lb., water 100 gal.; or hydrated lime 8 lb., water 100 gal.	Leaf hopper.
During certain seasons this spray can be combined with the preceding.		
Special rose chafer spray. Apply as soon as the beetles appear.	Confectioners' glucose 25 lb. or cheap molasses 2 gal., arsenate of lead 5 lb., water to make 100 gal.	Rose chafer.

GENERAL REMARKS

Arsenate of Lead—The amount of arsenate of lead is given in these schedules for powder form; if paste form is used, twice as much is required.

Lime-sulphur—The directions for lime-sulphur are based on the standard strength 32 to 34 degrees Baume solution.

Wettable Sulphur—For making the wettable sulphur spray, 8 lb. hydrated lime, 16 lb. superfine sulphur and 1 lb. calcium caseinate are used in 100 gal. water. The materials can be mixed dry during the winter or rainy weather and stored for use. It is prepared in the spray tank as follows: Fill the tank half full of water; then, with agitator running, add the dry material slowly, directing the spray nozzle upon the material until it has all disappeared in the water.

Cause of "Small Cherry"

SMALL or dwarf cherries are not due to disease but are the result of too heavy applications of acid lead arsenate, according to W. O. Gloyer, pathologist at the experiment station at Geneva. This fact was brought out in a recent study of English Morello cherries.

While other factors may cause dwarfing of cherries, Prof. Gloyer claims that the condition known as "small cherry" follows application of lead arsenate in the last two sprays given just as the fruit begins to color and two weeks later. Since insects prevalent at this time necessitate the use of arsenic sprays, the only remedy is to use a compromise spray or a dust in which the minimum amount of arsenic that will control the insects is combined with a high percentage of lime.

Where possible, it is recommended that a light application of 90-10 sulphur-lead arsenate dust be substituted for the spray made at the time the fruit shows color, to be followed by an application of plain sulphur just before harvest. Unless small cherry has caused serious losses in past years, there is no need for changing the usual spray practice.

A similar injury to prunes has been observed, according to Prof. Gloyer, and the causes and methods of treatment are much the same as for English Morello cherries. A detailed report of the experiments may be obtained from the Agricultural Experiment Station, Geneva, N. Y.

"How did the Smith wedding go off?"

"Fine until the parson asked the bride if she'd obey her husband."

"What happened then?"

"She replied, 'Do you think I'm crazy?' and the groom, who was in a sort of daze, replied, 'I do.'"

Zinc Chloride for Pear Blight Cankers

By Leonard H. Day
University of California

THE TREATMENT for pear blight cankers recommended by the California Experiment Station was used by many growers with good results in 1927. One standard solution was advised in the first recommendations given out, although at that time it was known that a weaker solution, properly used, would give satisfactory results. The station now considers it practicable and desirable for growers to use two strengths of solution.

The wide use of the *standard solution* the past spring and summer has brought out the following facts: (1) Orchards varied widely in the size of branches that could be treated without injury—in some orchards branches one and one-quarter inches in diameter were successfully treated while in others all branches under two or three inches in diameter were killed; (2) that the graft union of young trees (up to eight or 10 years of age) is often killed; (3) that the trees absorbed the zinc chloride solution more freely after the third week of June (previous experiments had shown that stronger solutions could be used during the spring than during the summer and fall); (4) that the solution seldom failed to stop the blight; (5) that the cambium layer was usually killed if the canker was over 10 days or two weeks old—except in cases of shallow-running cankers; (6) that trunk infections were often too old to treat successfully before discovered; (7) that in case of old deep cankers treated during June and July the branches did not wilt till after the fruit had matured; (8) that old cankers on one side only of a branch, trunk or root crown were cured with much less injury than is occasioned by surgical methods and that the percentage of cases cured was much greater than in surgical treatments; (9) that the treatment has been very valuable in cases where it is impossible to decide whether or not the disease has yet passed from the infected twig into the larger branch; (10) that scales should not be removed in order to treat scaly barked trees unless these are already loose and ready to fall off naturally.

Previous experiments have shown also that dormant or nearly dormant cankers can often be treated successfully with weaker solutions, even on old branches, trunks and roots.

In consideration of the above facts and also based on experiments extending over several years in the use of various strengths of zinc chloride solutions the following program is suggested:

Spring Program—April, May, June

Solution No. 1 (*Weaker Solution*).—
- (a) Smooth-barked branches under two inches in diameter. (See (Note a, below)
- (b) Roots and lower parts of trunks of trees under nine years old. (Note b)
- (c) Roots under four inches in diameter.
- (d) Upper parts of trunks of trees *under* four years of age. (Note b)

Solution No. 2 (*Standard Solution*).—
- (e) Branches over two inches in diameter. (Note e)
- (f) Trunks and root crowns of trees over nine years of age.
- (g) Roots over four inches in diameter.
- (h) Upper parts of trunks and crotches *over* four years. (Note b)

Summer, Fall and Winter Program—July 1 to April 1

Solution No. 1.—
- (i) Smooth-barked branches under four inches in diameter.
- (j) Roots and lower parts of trunks under nine years. (Note b)
- (k) Upper parts of trunks and crotches under six years.
- (l) Roots under four inches in diameter.
- (m) Dormant and slowly active cankers, all ages of trees. (Note m)

Solution No. 2.—
- (n) Smooth-barked branches over four inches in diameter.
- (o) Lower parts of trunks and root crowns over nine years.
- (p) Upper parts of trunks and crotches of trees over six years.
- (q) Roots over four inches in diameter.

Note a. In some orchards solution No. 1 should be used on branches up to three inches or more as No. 2 is too penetrating. This can be determined only after a season's trial.

Note b. Do not use No. 2 solution on the lower parts of trunks of young trees. Use No. 2 above and finish the lower 10 inches with No. 1.

Note e. Smaller branches also if scaly barked.

Note m. Use No. 1 solution on old cankers even if active regardless of size of branch or trunk, or age of tree, when it is uncertain whether there is enough cambium left to enable the tree or branch to recover. No. 2 solution will kill the cambium layer of these deep cases. If these deep cankers are active, then No. 1 solution may not always stop the disease in cases of trunks or large branches.

Formulas

Both solutions are prepared by dissolving dry zinc chloride in the following solvent:

Solvent:
- 1 gallon denatured alcohol
- 1 pint water
- 3 ounces concentrated, commercial *hydrochloric acid*

Solution No. 1 (*Weaker Solution*):
Dissolve six pounds zinc chloride in the above quantity of solvent.

Note: Solution No. 1 may also be prepared by adding three pints of solvent to one gallon of the standard solution.

Solution No. 2 (*Standard Solution*):
Dissolve nine pounds of zinc chloride in the above quantity of solvent. Note: Add a few drops of Methyl Orange to make this solution red.

The California station at Davis expects to print a circular giving full details about this method.

The Editor's Mail Box

Kinds and Sizes of Pipe for Stationary Spraying Outfit

Editor, AMERICAN FRUIT GROWER MAGAZINE: I am planning to install a stationary spraying plant and to lay three-eighths inch pipe through my orchard. Would you recommend black pipe or would it be more economical to buy galvanized pipe? Would the chemicals contained in Bordeaux corrode black or galvanized pipe to the extent that its usefulness for high pressure would be impaired? I use 200 to 300 pounds pressure. My experience makes me believe that an oil emulsion spray used early in the season keeps the spray rig from being messed up so badly by later sprays. Would this oil keep the later sprays from corroding the pipe line also, in your opinion?—C. V. R., Arkansas.

ANSWER: According to the United States Bureau of Public Roads, small black wrought iron pipe will last 10 to 20 years in the ground; galvanized steel, 15 to 30 years; galvanized wrought iron, 20 to 40 years; and lead and cast iron, 40 to 75 years. The life of any pipe will vary with its thickness, the corrosiveness of the materials which pass through it, and the pressure under which it operates.

Ordinary galvanized pipe is used in most of the western installations. Such pipe is said to seldom burst under a pressure of 1000 pounds or less. Second-hand pipe is sometimes used and will ordinarily resist 500 to 700 pounds successfully. Commercial black pipe is also used by some growers successfully. This kind of pipe can be more readily worked than galvanized pipe.

I note that you expect to use three-eighths inch pipe. This will be of insufficient size except for short runs. Mains that are 500 to 1000 feet long may be of one-inch pipe. Laterals of 500 feet or less should be of three-fourths inch pipe. These sizes of pipe will supply one spray gun at high pressures. If laterals are longer than 500 feet, you will need to use larger pipe or be satisfied with a lower pressure.

Bordeaux will not corrode pipe sufficiently to be of appreciable damage, provided the lines are washed out with clear water after each spraying. I do not have any information regarding the value of oil emulsion for coating the inside of the pipe and preventing corrosion from later sprays. It seems to me, however, that the use of oil emulsion or even pure oil should have some value in this connection.

Control Methods for Cherry Leaf Spot

Editor, AMERICAN FRUIT GROWER MAGAZINE: My cherry trees shed their leaves in August and had the appearance of being dead. On the fifth of October they came out in bloom and showed a few leaves. I do not think they will live. Please give me your opinion as to what can be done, if anything.—E. S., Illinois.

ANSWER: Apparently your trees were affected by leaf spot. This disease attacks the leaves and often causes defoliation of the plants during the summer or early fall. The only way you can control the disease is to keep the foliage well sprayed. I would suggest that you make an application of Bordeaux just after the shucks are pushed off most of the small fruits. This will perhaps be a week or two after the bloom falls. You should make another application about the time the cherries are beginning to turn or before. Make still another application after the crop is ripened. Be careful not to apply spray too near the time of ripening, as it may discolor the fruit and interfere with its marketability.

The blooming of your trees in the fall was no doubt due to the resumption of growth after loss of the leaves in the summer. It may leave your trees in a weak condition, and they may suffer more or less from winter killing as a result. I would suggest that you place a mulch around the trees to prevent deep freezing of the soil during the winter and also that you give the trees a liberal application of manure or quick-acting nitrogen fertilizer, such as nitrate of soda or ammonium sulphate, early in the spring about the time the buds are beginning to swell. This treatment is recommended, of course, if your trees show life in the spring. If they do not, there will be no advantage in using it.

The Raspberry Fruit Worm

Editor, AMERICAN FRUIT GROWER MAGAZINE: I would like to know if you can give me any information in regard to keeping worms out of the pores of the fruit and the centers of red raspberry plants. The berries are so badly affected that they are not fit for use.—T. E., Illinois.

ANSWER: The raspberry fruit worm is probably causing your trouble. The adult of this worm is a beetle that is yellow to pale brown in color and coarsely punctured and covered with light colored hairs.

The larvae or worms are one-fourth to one-fifth of an inch long, cylindrical and tapering toward each end. The body color is yellowish white and the head is amber colored, with the mouth parts darker.

This insect can be controlled fairly well with powdered arsenate of lead at the rate of two pounds to 50 gallons of water, applied just before the beetles begin to appear in the spring. This is usually during early May. It will probably be a good thing to repeat the application after 10 days to two weeks.

The insect passes the larval stage and the pupal stage in the ground, and thorough shallow cultivation continued until late in the fall will break up the pupal cases and expose the insects to the weather. It is probable that poultry will destroy many of the insects if allowed to run among the berries in the summer and fall. Particularly would the poultry be valuable if you keep the ground cultivated.

Delaying the Blossoming Date by Spraying

Editor, AMERICAN FRUIT GROWER MAGAZINE: Please tell us in the AMERICAN FRUIT GROWER MAGAZINE how, when and what to spray with as a protection against freezing during the winter or spring.

Most of the fruit in this vicinity was killed last spring by freezes. On a trip to Knobview, Mo., I saw apple orchards and grape vineyards loaded with fruit while just across the fence other orchards had practically no fruit. An Italian explained the situation by saying that the fruitful orchards and vineyards had been sprayed, while the others had not. I think the idea is that a certain spray applied at the right time in the summer or fall will cause the leaves to hang on until late in the spring, thus protecting the buds by retarding their growth.—G. F. L., Missouri.

ANSWER: I regret that we have no information on the point you raise. I do not know of any spray that would cause the leaves to hang on until late in the spring, and I do not know that such a condition, if obtainable, would delay opening of the buds.

The question is often raised as to whether the twigs and branches could be coated with some material that would delay blossoming in the spring. As you are probably aware, white surfaces have the effect of reflecting the heat from the sun's rays while dark surfaces tend to absorb the heat rays. It would appear, therefore, that whitewash sprayed onto the trees would reflect off the heat rays in warm spring days and would thus delay blossoming. In practice, however, the proposition does not seem to make sufficient difference to be of practical value. Whitewash has been sprayed on trees by careful investigators, but negative results have always been obtained so far as I know.

Possibly the spraying mentioned by the Italian saved the crop by means of control of insects and diseases, while the crops on the unsprayed orchards and vineyards were lost from lack of control.

Tractors for Cultivating Small Crops

Editor, AMERICAN FRUIT GROWER MAGAZINE: I was interested in what you said about small garden tractors some time ago. I want to buy one of these this spring for my strawberries and truck crops and will appreciate your opinion as to the number of rows it is practicable to handle at one time. If I can cultivate three rows to advantage, I want to do so. —J. E. R., Iowa.

ANSWER: I presume you have reference to small crops that are ordinarily planted close. You can get machines that will handle from one to three rows at a time. Some machines are adjustable for different numbers of rows.

If your ground is handled in comparatively large "lands" and is level and smooth, you can handle three rows at a time very nicely. However, if it is handled in small "lands" or is more or less uneven on account of furrows and ridges, you will find that the three-row cultivator will not do a first-class job. The tools will run too deep in places and in other places they will run out of the ground. A two-row or a one-row machine will do better work on land of this kind. A two-row machine in such a case would have to straddle two rows, and it would be an advantage if it were adjustable to fit rows of varying widths.

When you purchase your machine, you will need to buy a seed drill to plant the same number of rows you expect to cultivate at one time. You must have your rows perfectly parallel in order to cultivate two or three at a time. Of course, you will have to follow the same two or three rows that you plant at one time with a drill.

For the larger crops, including strawberries, you will usually find it best to cultivate one row at a time. A machine which has considerable clearance is preferable for crops of this kind.

Resolutions by Indiana Growers

EDITOR, AMERICAN FRUIT GROWER MAGAZINE: At the annual meeting of the Indiana Fruit Growers' Association, the following resolutions were adopted:

We, the Indiana Fruit Growers' Association, in convention assembled, view with alarm the ever increasing shipments of bananas into our country which serve as an impediment to increased consumption of American fruits, we therefore

Resolve, that our Indiana senators and members of Congress be acquainted with the fact that bananas are grown in foreign countries by low paid labor living under low standards; that the importation of bananas equals the annual carlot shipments of apples; and that the prosperity of apple growers is seriously threatened by this unfair and unjust competition, and therefore we urge upon our representatives and senators in Congress that they use their efforts to have placed upon the importation of bananas an equalizing tariff in the interest of the fruit growers of the country and that copies of this resolution be sent to our members in Congress.

Resolved further, that the Indiana Fruit Growers' Association enter into correspondence with other similar organizations of American fruit growers, including their co-operative societies, with the view to considering the creation of a national committee or institute to further the general interests of the fruit growers of the country in legislative and other business matters.

A committee was appointed consisting of John Napier Dyer, Vincennes; Frank Plass, Decker; and E. V. Hawkins, Mitchell, to communicate with C. E. Durst, managing editor of the AMERICAN FRUIT GROWER MAGAZINE, and W. H. Settle, president of our farm bureau, regarding the last resolution.

It is our desire that you publish these resolutions in an early issue of the AMERICAN FRUIT GROWER MAGAZINE.—*S. W. Holmes, Secretary-Treasurer, Indiana Fruit Growers' Association.*

A New Zealand Opinion About Bananas

EDITOR, AMERICAN FRUIT GROWER MAGAZINE: The October issue of your magazine has just been received after considerable delay. Mrs. Lee and myself greatly enjoyed your article about the Dunlaps. No doubt fruit growers' wives will be clapping you on the back for your description of the furniture and fittings in the Dunlap home. But we wonder if the fruit growers will not be wreaking their vengeance on you for starting something.

But the most outstanding statement in the magazine was the fact that you Americans allow 58,558,364 bunches of bananas to come in duty free from countries of cheap, low standard labor while you have thousands of tons of splendid fruit going to waste in your orchards. I am sure every orchardist and farmer in the Dominion will join me in saying that our American cousins are a lot of "softies." You should have a tariff of at least two to four cents per pound on bananas. Tariffs of this kind are the one thing that all of our people on the land will support. They feel that no food product grown in cheap labor countries should be allowed to enter our own markets unless it pays custom duties to balance the extra cost of our labor here.

What is the use of a country training and employing hundreds of professors and thousands of assistants on research work to assist farmers and fruit growers in securing greater production at enormous cost and at the same time allow products grown by the cheap labor of foreign countries to enter the country duty free to compete with American grown products? The company engaged in this trade is coining money while the strawberry growers of the Ozarks, for instance, are getting a paltry $75 per acre for their product, not enough to pay the cost of production. It is a perfectly rotten affair.—*George Lee, Templeton, Canterbury, New Zealand.*

Black Walnuts Will Not Come True from Seed

Editor, AMERICAN FRUIT GROWER MAGAZINE: I wish to start some black walnut trees. Will they come true to variety from seed? Should the nuts be left in the ground all winter to freeze open, or should they be cracked open in the spring?—P. H., Kansas.

ANSWER: Black walnut trees will not come true from the seed. To get a variety true to type, you will need to take buds or scions from the desired varieties and bud or graft these onto seedling roots. The best results are usually obtained from planting the nuts in the fall. Plant them with the hulls on and without cracking them. Plant two or three in a place and cover four to six inches deep with soil. If the seedlings make a good growth, you can bud them the following August or you can graft them early the next spring. Farmers' Bulletin 1501, which you can obtain from the Secretary of Agriculture, Washington, D. C., will give you detailed information on the propagation of walnuts.

The Market Review

By Paul Froehlich
United States Bureau of Agricultural Economics

FINAL crop reports for 1927 were issued a short while ago and they include some interesting figures. Compared with the November preliminary report, the total apple crop estimate was increased about 4,000,000 bushels to 123,455,000, or half of the production for 1926. The commercial apple crop is now placed at 25,900,000 barrels—about 2,000,000 more than in November, but one-third less than in 1926. Most of the increase over the November report was in Maryland, Virginia, West Virginia, Idaho, Washington and California. The 1927 peach crop estimate was reduced slightly to 45,463,000 bushels, but pears were raised since November to 18,072,000 bushels. Grape production estimate was lowered to 2,464,712 tons. Compared with 1926, peaches were lighter by 35 per cent, pears were lighter by 28 per cent, but grapes were a slightly heavier crop.

Oranges in California and Florida for shipment during the present season are estimated at 32,540,000 boxes, or 16 per cent less than last season. The Florida grapefruit crop is figured at 6,300,000 boxes, compared with 7,800,000 in 1926, and California lemons at 6,400,000 boxes are a 17 per cent lighter crop than last season. The January freeze probably will cause a further reduction in estimates for Florida citrus. The value per unit of the various tree fruits and grapes is much lighter than in 1926, but, in about half the cases, total farm value is less, because of the sharply reduced crop. The total commercial apple crop has a value one-fourth greater than last season, since the estimated value per barrel is nearly double that of 1926. Combined farm value of the seven important fruits is reckoned at $448,000,000, compared with $486,000,000 last season. The cranberry crop in five states is estimated at 496,000 barrels, or one-third less than in 1926.

The Public Protected

When citrus fruit has been injured by freezing, it may not be shipped in interstate commerce, if it fails to meet federal requirements under the Food and Drug Act. Sometimes frozen fruit shows discoloration around the stem-end or becomes soft and mushy. Most serious is the drying-out of the fruit segments, as a result of the rupturing of cells and evaporation of juice through the skin. The federal law in this respect is designed to protect the public from purchasing fruit unsuitable for human consumption. The ruling of the Bureau of Chemistry is that oranges are considered adulterated, within the meaning of the Food and Drug Act, if 15 per cent of any lot shows marked dryness of 20 per cent of the area of the cross-section of the fruit. Following the freeze of January, 1927, large quantities of Florida citrus were withheld from shipment and were a loss. At this writing, net results of the freeze in January, 1928, had not been determined, but it seemed fairly certain that some damage occurred and that total shipments for the season would be reduced.

Probably half the Florida orange crop had been shipped by early January. Movement by the tenth of the month exceeded 9000 cars, but was one-tenth lighter than the year before. Output of grapefruit was practically equal to the corresponding record for the 1926-27 season, though production is fully 20 per cent lighter. Texas had already shipped more grapefruit than during all of last season. California lemons were in very light supply, and orange shipments after the first of the year were only about half as heavy as during early January, 1927. However, with a record of 7500 cars to date, California was running only 15 per cent behind its last season's total to the same time. Louisiana has shipped more than 100 cars of oranges, compared with only one car last season, and the Alabama output of Satsumas was nearly twice as heavy as in 1926. Mixed citrus shipments from Florida were approaching the 3500 car mark, or 1000 more than to mid-January last year.

Markets for citrus fruit continued in rather satisfactory condition, with shipping point prices quite encouraging. Desirable sizes of Florida oranges were bringing $4-$4.75 per box, f. o. b. the central part of the state, while grapefruit ranged $3.25-$3.75. Some operators were expecting higher prices after the extent of freeze damage is determined. An interesting sidelight relating to the effect of cheap citrus on the demand and consumption of apples and other deciduous fruits is found in recent reports from England and Germany. The Spanish orange crop is heavy, and large supplies of these cheap oranges in consuming centers of the United Kingdom and continental Europe were apparently helping to reduce the demand for sale of apples from America.

Northwestern Apple Situation

Encouraging reports continue to come in from the Pacific Northwest. At an extreme f. o. b. range of $2.10-$3.50, leading varieties of Extra Fancy grade apples were still bringing $1 per box more than last season. Growers in Idaho are likely to get out of debt for the first time in several years, according to local reports. The season's shipments from Idaho probably will exceed 7500 cars, and prices have been satisfactory. Local estimates indicate possibly 15,000 cars from the Wenatchee district of Washington, as practically every marketable apple is being shipped. Last year, a visitor could see huge piles of culls out along the Columbia River, while this season many of this kind have been sold as high as $15 per ton. Probable total shipments of apples from the Yakima district are 10,000 cars. Hood River had a very short crop. There has been a relatively small pack of Extra Fancy grade in the Northwest this year, and expectations are that shipping point prices will advance further. The season's total apple shipments from all states are now officially forecast at 94,000 cars, compared with 134,000 last season. This means about 20,000 cars yet to move, as against 26,000 after January 10, 1927.

A news item from the Lewiston district of Idaho tells of the record yield from two Rome Beauty trees this season. These two trees averaged 54 boxes each, or about 2700 pounds of fruit per tree. If the apples were of usual size, it would mean around 6000 apples from each tree—enough to feed a good-sized town for several days. Idaho has nearly twice as heavy a commercial crop as last season, and even a greater production than in 1925. Total estimated farm value of apples in that state is $6,600,000. Washington growers probably will receive a total of $33,000,000 before the season is finished, and Oregon apple growers almost $5,000,000. Total farm value of apples in the three states is estimated to be $10,400,000 above the value of their 1926 crops, though combined production is 10,400,000 bushels less. New York is the only state having anywhere near as valuable an apple crop as the state of Washington, but New York's figure is only around $20,000,000. The Potomac-Shenandoah Valley region as a whole approaches a little closer to the Washington crop value. Cold storage Baldwins from western New York were bringing upwards of $6 per barrel during early January, while Rhode Island Greenings ranged as high as $9 and $11 in a few cities.

Foreign market prices improved slightly after the holidays, but were not up to the level for which some operators had hoped. Top price on the Liverpool auction was around

$8.75 per barrel or $4.40 per box.. Yellow varieties and New York Imperials were bringing highest prices. During the closing week of 1927, exports from United States and Canada were 55,000 barrels and 229,000 boxes, according to reports of the International Apple Shippers' Association. This was less than half as many barrels as during the same week in 1926, but twice as many boxes. Total exports to date are only a little over half those to the same time last season.

Apples Moving Rapidly From Storage

Compared with previous seasons, the shortage in cold storage stocks of apples is becoming greater and greater. On January 1, combined holdings were less than 27 per cent less than the year before, whereas on December 1 the difference was 25 per cent. This month the cold storage stocks are 16 per cent less than the five-year average for January, while the December total was only 12 per cent less than average for that month. The report for January 1 showed 1,673,000 barrels, 12,250,000 boxes and 3,152,000 bushel baskets in cold storage plants. Holdings of barrels were 59 per cent lighter than a year ago and 62 per cent below average. The cold storage supply of boxes was just about midway between the 13,365,000 average on January 1 last season and the 11,368,000 average for this time of the year. In contrast with the great shortage of fruit in barrels, it should be noted that holdings in boxes are slightly above normal and only a little below the 1927 figure. Bushel baskets in cold storage are only 27 per cent greater than a year ago, which indicates an active movement out of storage during December. Net withdrawals during December were approximately 390,000 barrels, 1,080,000 boxes and 750,000 baskets.

Spanish Grapes Still Excluded

Last fall, there was considerable agitation in favor of again permitting grapes from the Almeria province of Spain to enter the United States. A representative of the Department of Agriculture was sent abroad to make a thorough study of local conditions, and he ascertained that the Mediterranean fruit fly still exists throughout the Almeria grape districts. The action of the department, therefore, in continuing its ban on Spanish grapes is believed to be fully justified. This ban has been in effect since 1923, prior to which time the annual total imports of grapes amounted to 1,335,000 cubic feet.

About 74,500 cars of grapes have been shipped from California's record crop of 2,264,000 tons. Approximately 142,000 tons were not harvested. Shipments were fully 10,000 cars greater than in 1926. Estimated farm value of the crop exceeded $56,000,000 in California and $11,000,000 in other states. Eastern output was relatively light. Production of raisins in California was increased from 272,000 tons in 1926 to 285,000 tons, on a dried basis, in 1927. A little more than half the total harvested crop was used for drying.

A clearing house of grape growers and shippers was operated in California the past season. Well informed persons give credit to the clearing house for a very desirable stabilizing influence and an effective distribution of the heavy crop. The plan involved primarily the collection and dissemination of important daily information as to the sales and quotations, shipments by varieties, and the distribution and supplies of grapes in eastern market by three classes—table grapes, black juice grapes and white grapes. Sales of over 20,000 cars were reported by shipper members of the clearing house, and the daily statistical reports were probably the most complete ever made available to the industry. Prices were maintained fairly well throughout the season, with few sharp rises or declines. More than 300 shippers, controlling at least three-fourths of the total tonnage, were enrolled in the clearing house. At certain periods, when exceptionally heavy output threatened to disrupt the market, recommendations affecting distribution were followed with decidedly beneficial results. As an interesting sequence, there now are rumors of the possible organization of a similar clearing house for growers and shippers of California deciduous fruits in 1928.

A New Insect in New York

A NEW INSECT of apples appeared in western New York last summer. It is the apple and thorn skeletonizer, and it was responsible for the browning and blighting of the foliage which was so noticeable along the highways, especially in unsprayed or poorly sprayed orchards.

According to authorities of the experiment station at Geneva, the insect is new in New York, although it is well established in Europe. It was first discovered in the United States in the lower Hudson River Valley in 1917. It has since spread up the valley to Albany, eastward into Connecticut and Massachusetts, and westward in New York. Last season was the first one in which the injury was extensive enough to attract attention.

The apple is the preferred food plant of the skeletonizer. The caterpillars feed almost entirely upon the upper surface of the leaves. When full grown, they are about half an inch long, yellowish green in color and are marked with tiny black spots. Three generations usually develop between June and October. The first brood causes the most damage. In cases of severe injury, the fruit is often poorly colored and under sized, and in cases of complete defoliation the succeeding year's crop may be lost.

The skeletonizer may be killed readily by applications of arsenate of lead. Trees which receive the regular apple spray schedule throughout the season usually suffer little if any injury from this pest.

A good bulletin on "Farm Storage for Fruits and Vegetables" has just been issued by the Portland Cement Association, Chicago, Ill. Copies may be had for the asking.

Take Care of the Spray Hose

By J. Marshall Porter

THERE are many years of service in a good spray hose if it is given proper care, but in many cases the hose is never thought of until it is needed. It is then often found to be useless because the rubber has become dry as a result of the hose hanging in a dry shed and when pressure is applied, the hose bursts. Also, a good hose is often made useless because mud bees have built in it.

It is a good idea when you have finished with the sprayer to take the hose off and run clear water through it to clean the spray material out thoroughly. Then make a small wooden plug for each end to keep the bees out, coil the hose into a small roll and hang in the cellar, where there is just enough moisture to keep the dry rot from destroying the rubber.

It takes only a few minutes to do this, and one hose treated this way will outwear five that are left on the sprayer in the dry shed.

Orchard Spray Progam for the Pacific Northwest

By Leroy Childs, Hood River Experiment Station, and H. P. Barss, Oregon Agricultural Experiment Station

On account of the climatic differences existing in the more humid orchard sections west of the Cascade Mountains and the semi-arid and irrigated regions east of this range, the conditions as to pests and diseases are different and require a somewhat different spray program. In general, there are a greater number of diseases and pests to be sprayed for in western Oregon, Washington and British Columbia than in the drier orchard sections of the interior. Hence, the full spray program for the section west of the Cascades will be presented and then followed by paragraphs outlining the program for other sections.

SPRAY PROGRAM I

For humid sections of Washington, Oregon and British Columbia west of Cascades

APPLES AND PEARS

Time of Application.	Materials to Use.	For Control of.	Remarks.
(1) Dormant spray. As winter buds swell just before opening.	Lime-sulphur 12 gal., water to make 100 gal.; or miscible oil 8 gal., water to make 100 gal.	San Jose scale, blister mite, spider mite.	Use Dormoil 8 or 10 gal., water to make 100 gal., as green tips emerge when leaf roller is present.
(2) Pre-pink spray. Cluster buds open just enough to expose blossom buds.	Lime-sulphur 3½ gal., water to make 100 gal.	Scab and powdery mildew.	If anthracnose is under good control, use 6-6-50 Bordeaux here instead of summer spray. Add ¾ lb. nicotine sulphate to 100 gal. spray when aphids are present.
(3) Pink or pre-blossom spray. Just before blossoms open.	Lime-sulphur 2½ gal., water to make 100 gal.	Scab and mildew.	For fruit worms and bud moth, add 3 lb. lead arsenate to 100 gal. spray.
(4) Calyx spray. As last petals fall. Before apple calyx closes on central fruit in cluster.	Lime-sulphur 2½ gal., arsenate of lead 2 lb., water to make 100 gal. (see footnote 2.)	Scab, mildew, codling moth on apple, fruit worm on pear.	To control moderate leaf roller infestation, use double quantity lead arsenate.
(5) Fifteen-day spray. About 15 days after petals fall.	Lime-sulphur 2 gal., water to make 100 gal. (see footnote 2.)	Scab, mildew.	Add lead arsenate 2 lb. to 100 gal. spray for pear slugs.
(6) Thirty-day or first cover spray for worms. Three to five weeks after petals fall.	Arsenate of lead 2 lb., water 100 gal.	Codling moth.	Add wettable sulphur (see General Remarks) for scab and mildew.
(7) July spray. July 10 to 25, depending on locality and season.	Arsenate of lead 2 lb., water 100 gal.	Codling moth, second generation.	For anthracnose canker use 4-4-50 Bordeaux.
(8) August spray. August 10 to September 5, depending on season and locality.	Arsenate of lead 2 lb., water 100 gal.	Codling moth.	May usually be omitted on pear.

PRUNES AND PLUMS

Time of Application.	Materials to Use.	For Control of.	Remarks.
(1) Dormant spray. As winter buds are ready to open.	Lime-sulphur 12 gal., water to make 100 gal.	San Jose scale, spider mite, twig miner.	If scale is absent, use only 8 gal., water to make 100 gal.
(2) Pre-blossom spray. Buds white just before opening.	4-4-50 Bordeaux with spreader; or lime-sulphur 3 gal., water to make 100 gal.	Brown rot blossom blight.	For aphids, use nicotine sulphate ¾ lb. in 100 gal. For bud moth use arsenate of lead 2 lb., lime 2 lb., in 100 gal.
(3) First fruit spray. As soon as shucks fall.	Wettable sulphur (see General Remarks).	Leaf spot, brown rot.	
(4) and (5) About June 1 and July 1.	Spray with wettable sulphur (see General Remarks); or dust with sulphur.	Leaf spot or brown rot if troublesome.	
(6) August spray. About a month before harvest.	Spray with wettable sulphur (see General Remarks); or dust with sulphur.	Brown rot.	

PEACHES

Time of Application.	Materials to Use.	For Control of.	Remarks.
(1) Leaf curl spray. From December to mid-February.	6-6-50 Bordeaux.	Peach leaf curl.	
(2) Late dormant spray. Just as first buds are ready to open.	Lime-sulphur 12 gal., water to make 100 gal.	Peach twig miner, San Jose scale, spider mite.	If scale is absent, use 8 gal. lime-sulphur, water to make 100 gal. For bud moth, add arsenate of lead 2 lb., lime 2 lb., in 100 gal. spray.
(3) First fruit spray. As soon as shucks fall.	Wettable sulphur (see General Remarks).	Peach blight (fruit spot), mildew, brown rot.	If disease condition is bad, repeat at 2 or 3-week intervals.
(4) Late summer spray. About 6 weeks before harvest.	Spray with wettable sulphur (see General Remarks); or dust with sulphur.	Brown rot.	
(5) Early fall spray. As soon as each variety is picked.	4-4-50 Bordeaux.	Peach blight, die back.	For young trees or trees with no crop, apply in August.

CHERRIES

For San Jose Scale—Same as No. 1 in prune program.

For Aphids—Use nicotine sulphate 1 lb. to 100 gal. with pre-blossom spray (same as No. 2 for prune). Use tanglefoot bands on trees to prevent reinfestation of aphids by ants.

For Syneta Beetle—Use lead arsenate 4 lb., lime 2 lb. in 100 gal. water. The first year Syneta control is applied, put on this spray just before and just after blossoming; in succeeding years before bloom only.

For Cherry Fruit Maggot—Use the following sweetened poison spray for adult flies: Lead arsenate ½ lb., syrup 2 qts., water 8 gal. Apply about 1 qt. to the tree, spraying the upper surface of the outer leaves only, when adult flies appear. This will be from June 8 to 20. Repeat application 10 days later and give a third spray 1 week after second.

For Brown Rot (Monilia) Blossom Blight—Same as No. 2 in prune program.

For Cylindrosporium Leaf Spot (Yellow Leaf)—Same as Nos. 3, 4 and 5 in prune program.

For Brown Rot on Fruit—Use a wettable sulphur spray or sulphur dust 1 month before picking. Begin earlier if disease shows up sooner and repeat every 2 or 3 weeks till a month before picking.

APRICOTS

For Brown Rot (Monilia) Blossom Blight—Same as No. 2 in prune program. Where blossom blight has become very severe and in very wet springs, a similar spray may be desirable as the winter buds open, and another about in full bloom. Prune out and destroy all dead twigs and spurs in winter.

For Fruit Spot (Peach blight fungus)—Same as Nos. 3 and 5 in peach program.

San Jose Scale and Other Insects—Same control as for similar insects on peach.

SPRAY PROGRAM II

For semi-arid sections of the Northwest east of Cascade Range and for Hogue River Valley in Oregon.

APPLES AND PEARS

Scab—Present and troublesome only in a few localities. Where sufficiently abundant to justify spraying, apply Nos. 3 and 4 in Program 1 for apples and pears.

Powdery Mildew—Use applications Nos. 2, 3, 4 and 5 in Program 1 for apples. Continue if necessary. Observe footnote 2. Use casein spreader first dissolved in water. Supplement by winter and summer pruning out. Pink spray most important to avoid sulphur shock.

Codling Moth—Following the calyx application, the first cover spray (15 to 30 day) is applied just before the first worms hatch. In general, this will be earlier for interior (15 days) than for coast area. Follow with second cover spray 2 weeks after first cover spray; third cover spray, 4 weeks later; and fourth cover spray, 4 weeks after third.

For southern Oregon an additional late cover spray may be necessary. Double strength lead in late sprays advisable. Calyx spray on pears likewise advisable in southern Oregon.

For eastern Washington, northern Idaho and the Grande Ronde Valley of Oregon, follow Program 1, although in higher altitudes probably two cover sprays will generally suffice.

Citrus Red Spider—Use spray No. 1 in Program 1.

Blister Mite—Use spray No. 1 in Program 1. For apple see footnote 6.

Leaf Rollers, Fruit Worms, San Jose Scale, Aphids—Follow Program 1 for these insects.

PEACHES

Leaf Curl, Mildew and California Blight, Twig Miner, San Jose Scale, Spider Mite—Follow Program 1 for these diseases and insects.

CHERRIES

Practically no fungous diseases requiring spray. Insects in general would require no regular program of sprays. For specific pests follow Program 1 for cherries.

APRICOTS

California Blight—Follow Program 1 for peach blight. Insect pests and treatment same as for peaches in Program 1.

PRUNES AND PLUMS

No fungous diseases requiring spray as a rule.

San Jose Scale, Twig Miner and Spider Mite are principal insect pests. Where present, control with spray No. 1 in Program 1 for prunes and plums.

FOOTNOTES

1. **Where aphids** are very bad, especially with varieties somewhat resistant to scab, omit nicotine from application No. 2, adding it to application No. 3, which should then be applied just as soon as the blossom buds separate from each other. For severe infestations of brown aphids, the most satisfactory spray used in the Hood River Valley has been the oil spray applied as indicated in application No. 1 just as the buds begin to show green. However, if blister mite is present, see footnote 6.

2. **Lime-sulphur** will russet the skin of some varieties of pears like d'Anjou, Comice and Howell, and may cause burning of apples in hot weather. Under such circumstances substitute wettable sulphur spray. See General Remarks.

3. **Codling moth** control is such a complex problem and of such outstanding importance that too much dependence should not be placed upon a general spray program of this nature. Supplement the suggested program with all the trained assistance and advice obtainable. The most important period in codling moth control begins with the calyx spray and extends for 4 or 5 weeks thereafter. Where worm losses have been heavy, keep fruit thoroughly covered during this period as first brood worms are very active and the fruit rapidly loses its protective coating because of rapid growth. Because growers must eliminate arsenical residue on fruit for shipment, they should take extra care to control the first brood, giving an extra spray if necessary. No arsenical should be applied after mid-July, unless the worm situation positively requires it. The late cover spray may usually be omitted on pear. Supplement the spraying by careful collection of wormy fruit at thinning time; it pays. Scrape the scaly bark from the trees during February and March, band the trees in June, and destroy the accumulated worms every 2 weeks. For bad worm infestations, use 4 lb. lead arsenate to 100 gal. throughout the season. Codling moth is not a commercial orchard pest of British Columbia, and no program of control is required.

4. **Anthracnose** or black spot canker and fruit rot may be successfully prevented by a single thorough summer application of 4-4-50 Bordeaux. Where the disease is reasonably well under control 6-6-50 Bordeaux in application No. 2 is of much value in reducing infection without the disadvantage caused by the coating of the fruit with Bordeaux in the summer. The spring Bordeaux spray, however, must be applied before the fruit buds are much exposed, to avoid russeting. Bordeaux 6-6-50 applied with the oil spray is also proving of great value in the Hood River district in reducing anthracnose. In filling tank, add lime first. Fill tank two-thirds full; slowly add dissolved bluestone, lastly add oil, which, before adding, should be stirred up and emulsified with an equal amount of water. A very thorough application is necessary, as this spray must stay on the trees until fall, at which time it becomes effective in controlling the disease.

5. **Leaf rollers** occur as a major pest only in certain of our fruit sections. Oil emulsion in the early pre-pink (delayed dormant) is the standard spray. Dormoil has given uniformly better results in leaf roller control than other western oils. Some miscible oils are apparently of little value in control. Where conditions develop that prevent maximum effectiveness from the oil spray and for very light infestations of leaf roller, use double strength lead arsenate (4 to 100) in the pink and calyx sprays.

6. **For blister mite** on apple, apply lime-sulphur 10 to 100 (12 to 100 if the scale is present) any time after trees go dormant in the fall or in the spring before buds begin to open. Control cannot be obtained after green begins to show on buds. Oil 8 to 100 is effective during a much more limited time; this period is between the time scales are separating on buds and before green tips show. Warm, sunny weather greatly assists in increasing control. Every bud in the tree must be hit with the spray material, as the mites over-winter in the buds.

7. Three species of red spiders are troublesome in the apple and pear orchards of the Northwest. In some sections all are present, in others one or two of the three are present. Control measures for two are alike but for the third species a different recommendation must be made. On account of this situation, it is necessary to know the particular spider giving trouble. The so-called European red spider and the brown mite over-winter in the egg stage on the tree. The third species, or so-called common red spider, hibernates in trash on the ground and is not on the trees when the first spray is applied. Oil spray at the rate of 3% or more is recommended for the first two species indicated. For the common red spider, the usually recommended sulphur sprays applied during early spring are quite effective. If all three of these pests are troublesome in the summer, a weak oil spray containing ½% to ⅔% of lubricating oil is recommended.

GENERAL REMARKS

Lime-Sulphur—The directions in these schedules are based upon the use of lime-sulphur concentrate testing about 32 degrees Baume.

Where the powdered or "dry lime-sulphur" is used, it will take about 4 lb. of the dry powder to equal in active ingredients 1 gal. of the standard concentrated liquid lime-sulphur. For example, where this program recommends "lime-sulphur 12 gal., water to make 100 gal.," the grower employing the dry form should use 48 lb. of the dry lime-sulphur with every 100 gal. of water to get the same strength of spray.

Wettable Sulphur Sprays—Within recent years substitutes for lime-sulphur have been devised which do not have the caustic or burning action of the latter and hence are safer to use on tender-skinned varieties of pears and apples and on stone fruits. These sprays are not very active as fungicides or insecticides when the weather is cool and hence cannot always be relied upon for effective action in the early spring. They are, however, active in warm weather. It is usually advisable to employ a soap or casein spreader with them unless a spreader is used in the composition. These spray materials are much easier to prepare or use than the old self-boiled lime-sulphur and are to be recommended wherever the latter has been advised in the past. Among these wettable sulphur sprays may be mentioned the well-known atomic sulphur (use 12 lb. to 100 gal.), "dry-mix" sulphur and lime, and "Oregon cold-mix" lime and sulphur. To prepare the latter, use superfine sulphur 16 lb. and hydrated lime 8 lb. Mix together (thoroughness not required). Pour into the mixture 4 qt. milk (skimmed is entirely satisfactory) and stir into a smooth paste, adding water if too thick, and finally pour through strainer into spray tank with enough water to make 100 gal. with the amounts of materials mentioned. Other satisfactory materials are now on the market.

Arsenate of Lead—The directions in these schedules are based upon powdered arsenate of lead; if the paste form is used, double the amount.

Oil Sprays—Oil sprays are increasing in popularity throughout the country. Up to the present time, however, observations made in Oregon at least do not seem to indicate that an oil emulsion of less than 6% should be recommended for the control of San Jose scale. Some growers, after using oil for several years at the above strength, are going back to the use of lime-sulphur. Probably some unknown factors are influencing results obtained in different parts of the country.

Spreaders—Materials like calcium caseinate added to sprays to increase their spreading powers have not given increased control with such troubles as codling moth or scab.

Dusting—Dusting sulphur has given promising results in warm weather for mildew and brown rot control, but is not as active as ordinary lime-sulphur in cool weather as in early scab applications. No dusting material has thus far given as good results as liquid sprays for anthracnose, peach blight and other diseases requiring long, wet weather protection. The relative value of dust and spray for the control of insect pests cannot be stated exactly without further experimental work.

Spray Combinations—Any of the materials mentioned in this spray program in connection with any particular application may be successfully combined, but it is best not to add lead arsenate to a tank of diluted lime-sulphur until the last thing before starting to spray.

The Japanese Beetle Is Spreading

(*Continued from page 4*)

visable for communities only, it shows the way to kill beetles in huge numbers. The beetles are attracted to a tree or a particular location by the application of geraniol. It takes only a very few minutes to draw thousands of beetles to a central location. When the beetles have congregated on the tree or bush, the pyrethum soap contact spray is turned on the unsuspecting victims. The pyrethum paralyzes the beetles, the soap clogs their breathing pores, shutting off their air supply, and they die in a few minutes from suffocation. There are some new developments with this potent material that may result in a startling method of control in the near future.

Parasites Appear Promising

No discussion of the beetle is complete without the parasite. Located in the Orient, transported to New Jersey, acclimated in the laboratory, liberated in the field, it is now one of the most active and positive methods of control yet devised for checking the spread. Already it covers 70 square miles in the most heavily infested regions, and the beetle hosts are decreasing where the parasite is the most numerous. This tiny fellow—so active, yet so rarely seen—is doing a bigger piece of work than most people realize. So far, five species of the parasite have become firmly established, and they can be recovered in widely separated sections of the area.

Care has been taken in liberating the parasites. They have been placed in localities where the infestation has been quite serious, and as a result of these colonies, the beetles are disappearing in numbers. It may be just a coincidence, but accurate counts kept on the beetles in these localties show that for the past three years they have been decreasing. Two types of parasites have been introduced. One species attacks the tiny grubs while in the ground, and another one attacks the adult beetle while it is active and doing the most injury. All are active, appear to be adapted to New Jersey conditons and apparently are multiplying quite rapidly.

Millions Caught in Traps

Another line of attack, developed during the past two years, has proved particularly valuable and has resulted in the capture of millions of beetles. An ingenious trap for catching them was developed in 1925 at the laboratory which promises to be a valuable aid in control. Baited with a geraniol preparation, the beetles are attracted to the trap and enter by the thousands. Instances are known in which 10,000 have been caught in a day, and as many as 100,000 in a season. The traps are now being used by the hundreds. However, the trap is not recommended unless used as a supplementary measure in connection with one of the spray programs. It has been found that geraniol, if not used with discretion, may act as a boomerang and draw more beetles to a given locality than will be caught in the trap. If the foliage on the trees is not sprayed, the hordes of beetles will not all find the trap, and they will alight on the trees and destroy the foliage. If the tree is sprayed before placing the trap, a large kill of beetles will be secured, and the trap will be able to catch a large number of the remaining beetles. It has been found by actual count that 75 per cent of the beetles entering a tree that has been thoroughly sprayed will die from the poison they have taken. The results from the lead oleate coated arsenate of lead runs as high as 85 per cent kill.

Summary

Thus, with the varied line of attack the entomologists have built up against the beetle, the extent of the foliage injury is being minimized. All of these control measures have proved effective in controlling the beetle, besides being practical for the individual or the community, and can be performed at a price that is within the reach of everyone.

The sprays are practical; the traps are aiding, and the parasites are doing a big piece of work, with the result that the beetle numbers are gradually decreasing in certain localities where a real fight has been staged. While the beetle has been having a harder time year after year in a restricted area near Riverton, it has turned its attention to other points where the food is not covered with poisons and the ground filled with parasites. Its ramblings in other parts of the country presents a problem that the future alone can solve.

Cost Analysis of a Modern Spray Schedule

(*Continued from page 13*)

every other year, but every year.

Some persons may ask, isn't this a pretty stiff schedule and a pretty costly schedule to apply year after year?" My answer is "No." A price record or income record was not kept on this particular plot, and it is now impossible to tell the income per bushel or per tree, but a look at the price quotations before Christmas time on McIntosh and the late prices for large size Romes multiplied by the number of barrels given in the production record will give a clue to income received. Growers think nothing of the 45½ cent freight rate to New York. They take a charge of 60 to 70 cents for a barrel as a container as a matter of course. The commission charge of 60 to 90 cents per barrel on McIntosh is just another deduction. Is it not much wiser to put 30 to 40 cents per barrel into spraying costs—about four per cent of the $9 per barrel—to make sure that our prospective crop is not going to be 50 per cent, more or less, below profitable grade, due to scab, codling moth, leaf roller, red bug, aphis, lesser fruit worm, apple maggot, or any other of the many pests the modern horticulturist must fight to a finish? A good grower must figure his spraying cost as an insurance charge against loss by insect injury or fungous dangers. No sane man today lets his buildings go uninsured against fire. Similarly no sane man today lets his apple crop go uninsured against scab and the other pests of the industry. Some years by careful watching costs can be shaved down a bit. Other years, they must be increased a bit. It is not wise to let down much, however, on plots which are proving their ability to make a good profit even after a season of low prices like that of 1926-27.

He had proposed to her, as is still the custom with some people, and her answer had been "No, NO!" Can you imagine, then, why he crushed her exultantly to his manly breast and then rushed off to buy the license? Well, it's very simple: They were both English teachers and so knew very well that two negatives make an affirmative.

"Your partner has a complete education, hasn't he?"

"No, he's a bachelor."—*Boston Transcript.*

WELLS A. SHERMAN of the United States Bureau of Agricultural Economics, who was loaned to the California Vineyardists' Association for the purpose of directing the clearing house plan, gave a most interesting address to state marketing officials at Chicago in December.

Mr. Sherman raised the question as to whether the major emphasis must not be shifted from the effort to organize producer groups into the larger field of organizing industry groups. The new concept, according to Mr. Sherman, recognizes the fact that growers have in few cases been able to approach monopoly control of a commodity, in fact, there are two or more co-operatives in many sections competing for the marketing of the growers' products. The idea of the clearing house plan is to limit the competition so that it will not result in needlessly low prices to consumers.

Three clearing house plans are in operation in California. The most successful to date is that of the California Gravenstein Apple Growers. Mr. Sherman quoted E. C. Merritt, president, as saying that in 1926 there were 13 marketing agencies in this small section and that there are still eight co-operatives and three commercial shippers. Returns have been very close to the cost of production. In order to correct the situation, the growers decided to operate on a clearing house plan.

The growers are signed for 15 years and have the privilege to withdraw from one unit and join another, but they can market only through a clearing house member. Growers who prefer to sell through a co-operative form units accordingly, and those who wish to sell through a commercial agency form another unit, and so on. Each unit elects a director to the central organization. The total vote of directors representing commercial organizations must not exceed the vote of directors representing co-operative units. The directors have broad powers.

The clearing house is composed of representatives of the selling agencies and an equal number of growers appointed by the directors of the central body. Selling agents are signed up for 15 years, with the privilege of withdrawal after two years, and they can handle only the fruit of members.

Through the courtesy of the railroads, the Gravenstein growers obtained records showing the final distribution of their product for the last five years. This information helped greatly in working out distribution plans. A plan was developed whereby no shipper is permitted to make additional shipments to a market whose allotment is already filled. The security of the market is thus assured.

Shippers are allowed to sell in any market in proportion to their estimated tonnage as compared with the total crop. Each shipper makes a daily confidential report to the secretary of the clearing house, giving the number of cars shipped, the car number, destination, grade and whether rolled or sold. These reports are compiled, and a summary is sent to each member shipper.

The plan proved successful the past season. Prices were named at the beginning of the season which would net growers about 75 cents more than was received in 1926. These prices were maintained throughout the season, and some agencies even sold part of their output at higher prices. It is recognized that conditions were favorable because of a less than average crop, a shortage of competing crops, and a high purchasing type of consumers in most sections. Relations between shippers have been greatly improved as a result of the outcome, and growers and shippers are looking to the future with confidence.

THE SUPREME COURT of Arkansas recently held that all the members of a co-operative were liable for the debts of the association, even though the organization was not incorporated when formed. In this case, the officers signed two promissory notes for $1000 each. The money was used for building a curing house. The venture failed, and suit was brought by the holders of the notes. The court held that the only question involved was the identity of the persons who composed the association at the time the notes were executed. In other words, it held that all members at the time of organization were liable.

A NEW ENGLAND marketing conference was held at Boston, December 9-10. It recommended the completion of a commodity group organization in each state and the carrying out of an educational program to acquaint producers with its program for merchandising New England products on a graded basis.

The first necessity, in the opinion of the conference, is to interest a sufficient number of producers to grade and market their products according to standard grades to make possible a considerable concentration. When a sufficient volume is available, it was deemed a fairly simple matter to develop outlets among New England consumers for the home-grown commodities.

The conference a year ago recommended that each state legislature be requested to establish grades and standards for certain commodities. Such standards were fixed in five of the states but were not fixed in New Hampshire.

At the recent conference, grades were approved for eggs, apples, asparagus, celery, strawberries and bunched beets, carrots, turnips and globe radishes. An effort will be made to have these grades approved by the commissioners of agriculture in each state.

It is also proposed that a label be developed to place on New England standard products. The plan is to distribute and control the labels through the commissioners of agriculture.

ON NOVEMBER 9, the California Prune and Apricot Growers' Association, San Jose, Calif., had received 7,953,861 pounds of apricots of the 1927 crop for marketing. Apricot pits to the amount of 2,044,721 pounds had been sold. Prune deliveries were estimated at 100,000,000 pounds. A committee of five was appointed at the semi-annual meeting held on the above date to consider plans for reorganization of the association at the expiration of its present marketing agreement.

THE YEAR 1927 was a year without profit to the growers of canning peaches, according to the report of the California Canning Peach Growers, San Francisco. The big pack of 1926 was chiefly responsible. The management points out that supply must be reduced to fit the demand or consumption must be increased to take care of the output. Reduction of the output

by strict grading is regarded as practical and sound.

The association is chiefly a price bargaining organization. Each year it negotiates a price to be paid the members by the private firms which pack and market the crops.

The association packs a small quantity of fruit itself each year, which it also markets. In 1926, the association pack amounted to 334,000 cases and in 1927 to 324,883 cases.

The expense of operating the association during 1927 was $35,560 less than the income. Reserve capital on November 15, 1927, amounted to $197,870. The association withholds five per cent of the sales returns, and these amounts are returned to growers at the end of three years. The association has 1453 members, representing 19,028 acres of peaches.

A RECENT article in the *Sealdsweet Chronicle* states that Florida has too many packing houses, and it also emphasizes that the growers have paid for all of these houses, although they do not own them all.

Data collected by the Florida Department of Agriculture show that there are 354 packing houses in the state. The value is placed at $20,000 each, including equipment, which is considered very reasonable. At this rate, the investment represents $7,080,000.

It is quite obvious that the growers' fruit has paid for all these houses. If the growers owned them, there could be no complaint, but, unfortunately, they do not. More than half of them are owned by private operators. On a 50-50 basis, the loss to growers represents $3,540,000. Members of the Florida Citrus Exchange have built and are operating 82 packing houses.

A well equipped packing house can handle 200,000 boxes of citrus fruits during a season. Thus, 100 well equipped houses would be able to handle 20,000,000 boxes per year, which is the estimated average production for the next five years. The state, therefore, has 254 more packing houses than it actually needs to handle the fruit. This represents an unnecessary outlay in cost of houses and equipment, as well as in cost of operation, including labor, taxes and insurance.

FOR THE YEAR ending November 30, 1927, the Federal Intermediate Credit Bank of Spokane, Wash., reported loans to co-operatives in the amount of $5,849,315. This represents the largest volume of loans in any year since the bank was organized.

The increased loans have proved a direct aid to agriculture, as is indicated by the increasing number of co-operatives which have established credit relations with the bank.

Loans have been made covering alfalfa seed, dried prunes, canned fruits and vegetables, beans and honey.

A recent reduction of one-fourth of one per cent in interest rates to rediscounting agencies gives the borrowing organizations a rate of four and one-half per cent.

The bank is capitalized for $5,000,000 and has a loaning capacity of $55,000,000. Loans are made to agricultural credit corporations organized for the direct purpose of production.

NEW YORK, Boston, Chicago and Philadelphia consume about 55 per cent of the oranges shipped from Florida and California, according to the Bureau of Railway Economics.

Of the 42,290 cars of oranges unloaded for the year ending September, 1926, at 36 principal markets, these four cities received 23,016 cars or 54.5 per cent. Of this number, 8764 cars came from Florida and 12,928 from California. New York alone handled 32.6 per cent of the Florida unloads in the 36 markets and 24.1 per cent of the California unloads.

During the 1925-26 season, oranges from Florida, California and Porto Rico brought higher wholesale prices in New York than in any of the other markets. The average was $5.14 per box for Florida oranges, which was 44 cents above the price in Boston and 48 cents above the price in Philadelphia. It also was 50 cents higher than the Chicago price. The average price of California oranges in New York was $5.08 per box, which was 21 cents, 23 cents and 18 cents, respectively, higher than the average prices at Boston, Philadelphia and Chicago.

CITRUS ACREAGE in the Salt River Valley of Arizona is increasing at a rate of nearly 1000 acres a year, according to I. de R. Miller, general manager of the Arizona Citrus Growers, a co-operative organization representing about 98 per cent of the growers of the community.

The ultimate citrus acreage of the valley will be approximately 15,000 acres, he estimates, as compared with a present productive acreage of about 3000. Development of the valley citrus lands will be completed in six more years.

Extension of the citrus acreage has been limited in past years to the availability of nursery stocks, he added. A drastic quarantine law against the importation of citrus stocks from other states has resulted in comparatively small plantings. With the gradual increase in citrus acreage and the resulting increase in nursery stocks, annual plantings are showing material increases yearly.

The 1927-28 citrus crop of the valley averages up to the high standard of last year, Mr. Miller said. The crop of Washington Navels, the early variety of oranges, was short of the record production of last season, but the quality was unusually good. Practically the entire crop was marketed prior to Christmas, mostly at Chicago, Kansas City and Cleveland, with the valley fruits bringing a fancy premium over competitive crops.

The grapefruit crop this season is as large as that of last year, with the quality showing a bit of improvement. The bulk of the Arizona grapefruit crop is marketed in California. The Marsh Seedless variety is grown here almost exclusively.

Indications point to a good yield of Valencia oranges in the spring, and barring unforeseen climatic setbacks, the growers will reap a return equal to that of last season.

As any people grow richer, they eat less cereals and beef and pork and consume more fruit and vegetables.—*Roger Babson.*

Davis Gives Advice About Oil Emulsion

J. J. DAVIS, entomologist in Indiana, recently issued a statement in reference to oil content of certain oil emulsions now being placed on the market. Some of these preparations do not appear to contain the right type of oil, and they do not contain the 66 per cent of oil upon which dilution recommendations are based.

According to Prof. Davis, oil used in preparing the stock lubricating oil emulsion should have a viscosity of not less than 90 (Saybolt test). Growers should insist on this qualification. A check should also be made of the oil content of the stock emulsion. If it is to be diluted as recommended, that is, three gallons to 97 gallons for two per cent, and four and one-half gallons to 95½ gallons for a three per cent emulsion, the stock emulsion should contain 66 per cent of oil.

Oil emulsion sometimes separates when hard water is used, and under such conditions a ½-½-50 Bordeaux mixture should be used as a diluent. The above recommendations do not refer to the miscible spray oils on the market, Prof. Davis states.

Spray Table for Northern California

By Leonard H. Day, University of California

ALMONDS

For Control of.	Treatment.	Time of Application.	Remarks.
Shot hole.	Lime-sulphur 10 gal., water to make 100 gal.	Just as buds are swelling.	2-3-50 Bordeaux as jackets are shed from young fruits is also very promising.
Red spider.	(1) Heavy refined commercial oil (miscible or emulsion) 6 or 7 gal., water to make 100 gal. (2) Dust with dry sulphur or use 1½% summer oil spray.	(1) During dormant season. (2) As soon as mites appear and as often as necessary during the summer.	(1) To kill eggs of Bryobia. (2) To kill adults of tetranychus and of Bryobia. Spraying is most effective.
California peach borer.	See under peaches.		
Peach twig borer.	See under peaches.		
Red humped caterpillar.	See under prunes.		

APPLES

For Control of.	Treatment.	Time of Application.	Remarks.
Pear blight.	See under pears.		Zinc chloride treatment not demonstrated with apples.
Mildew.	Lime-sulphur 3 gal., water to make 100 gal.; or sulphur paste 8 lb., water 100 gal.	When petals fall. Several times during spring.	Apple trees injured by sulphur sprays in some sections. Careful pruning of diseased twigs aids in control. Consult county agent when disease is severe.
Scab.	(1) 4-5-50 Bordeaux; or lime-sulphur 5 gal., water to make 100 gal. (2) Lime-sulphur 3 gal., water to make 100 gal.	(1) As winter buds open. (2) As petals fall.	Later sprays necessary in coastal region.
Codling moth.	(1) Arsenate of lead 2½ lb., water 100 gal. (2) Same as No. 1. (3) Same as No. 1.	(1) As petals fall. (2) Three weeks later. (3) As needed.	In many sections 2 sprays are sufficient. The calyx spray is most important. In other sections 4 to 7 sprays may be necessary. Clean up around packing houses. Strips of sack bands about trunk very valuable during spring and summer.
Flat headed apple tree borer.	Soap naphthalene repellant.	Early spring.	Whitewashing young trees helpful. Tree protectors more efficient than whitewash.
Leaf roller.	Heavy refined commercial oil (miscible or emulsion) 6 or 7 gal., water to make 100 gal.	Dormant season.	To kill eggs drench trees thoroughly.
Green and rosy apple aphis.	(1) Lime-sulphur 10 gal., water to make 100 gal. (2) Nicotine sulphate 1 pint, fish-oil soap 5 lb., water 100 gal. (3) 5% or 6% nicotine dust.	(1) Late dormant. Just before buds open. (2) From bursting of buds until leaf buds are ½ in. long. (3) Same as No. 2.	(1) Fair results in killing eggs. (2) Results in somewhat better control than No. 1. (3) Material must be fresh and up to strength.
Red humped caterpillar.	See under prunes.		
Scale insects.	Heavy refined commercial oil (miscible or emulsion) 6 or 7 gal., water to make 100 gal.	Dormant season after first heavy rains.	Lime-sulphur is sufficient for San Jose scale. Some others require heavy oil emulsions.
Tussock moth.	Sprays ineffective.		Destroy egg masses in winter, band trees with Tanglefoot to prevent caterpillars from climbing trees.
Woolly apple aphis.	Distillate emulsion or miscible oil. P. D. B. in 2 rings around trees in fall for root form.	Winter months. September-October	Delicious and Northern Spy nearly immune. Use refuse tobacco stems around roots of young trees or older trees in home yards.

APRICOTS

For Control of.	Treatment.	Time of Application.	Remarks.
Bacterial gummosis.	Cut out diseased bark and disinfect; when dry cover with Bordeaux-oil paint.	Winter and spring.	Infections occur through wounds. Keep wounds covered with Bordeaux-oil paint. Inspect orchard at frequent intervals during winter.
Brown rot.	(1) 8-8-50 Bordeaux (2) 4-4-50 Bordeaux.	(1) Red bud stage. (2) When about 1/5 of blossoms are open and up to full bloom.	Cut out diseased twigs in winter. Remove fruit mummies. Avoid sulphur sprays on apricots.
Shot hole.	(1) 5-5-50 Bordeaux. (2) 5-5-50 Bordeaux. (3) 2-3-50 Bordeaux.	(1) Nov. 15 to Dec. 15. (2) Red bud stage, or (3) When jackets drop.	Spraying must be done thoroughly. No. 3 usually more important than No. 2.
California peach borer.	P. D. B.	September-October	Soil should be warm for best results.
Leaf roller.	See under apples.		
Brown apricot and black scales.	Refined commercial oil (miscible or emulsion) 5 to 6 gal., water to make 100 gal.	December to February.	Should not be applied until after first heavy winter rains. Cover new growth thoroughly.
Peach twig borer.	Basic arsenate of lead 3 lb., water 100 gal.	When flower buds are opening and showing fruits.	Do not use lime-sulphur spray on apricot trees. The lead arsenate can be combined with the first brown rot spray.
Red humped caterpillar.	See under prunes.		

OLIVES

For Control of.	Treatment.	Time of Application.	Remarks.
Olive knot.	Cut out thoroughly at first appearance and disinfect.		
Black scale.	Summer oil 1½% when young first hatch (August) or 2% when a few weeks old.	July to September.	

CHERRIES

For Control of.	Treatment.	Time of Application.	Remarks.
Bacterial gummosis.	See under apricots.		Topwork on Mazzard seedlings.
Leaf and fruit spot (shot hole).	See under apricots.		
Black cherry aphis.	Spray with nicotine-sulphate 1 pint, fish-oil soap 4 or 5 lb., water 100 gal.; or dust with 5% nicotine dust.	As soon as aphids appear.	
Cherry fruit sawfly.	Basic arsenate of lead 3 lb., water 100 gal.	When petals are opening.	
Cherry slug.	(1) Basic arsenate of lead 3 lb., water 100 gal. (2) 2% to 5% nicotine dust.	When slugs appear.	May also be controlled with hydrated lime or even dry road dust.
Pear thrips.	See under pears.		
Red humped caterpillar.	See under prunes.		

GRAPES

For Control of.	Treatment.	Time of Application.	Remarks.
Grape mildew.	Finest forms of dry sulphur.	(1) When new shoots are 6 to 8 in. long. (2) When new shoots are 12 to 18 in. long. (3) During or just preceding blossoming.	In cool or moist locations a fourth application when the berries are as large as small peas may be necessary.
California grape root worm.	Spray with basic lead arsenate 8 lb., water 100 gal.	As soon as beetles appear in spring.	Cultivate close to vines in winter to kill larvae.
Grape leaf hopper.	(1) Nicotine sulphate 1 lb., liquid soap ½ gal. (or hard soap 1 lb.), water 100 gal. (2) 50% calcium cyanide dust; or 10% nicotine dust; or 6% nicosulphur.	(1) Before nymphs develop wings. (2) When adults appear.	The nicosulphur will help control mildew.
Phylloxera.	Use resistant vines. Disinfect cuttings or rootings before planting by dipping in hot water (122° F.) for 5 minutes.		P. D. B. seems promising.

PEACHES

For Control of.	Treatment.	Time of Application.	Remarks.
Peach blight.	(1) 5-5-50 Bordeaux. (2) Lime-sulphur 10 gal., water to make 100 gal.	(1) After first fall rains, Nov. 15 to Dec. 15. (2) As buds show green in spring.	
Brown rot.	See under apricots.		
Mildew.	Dust with dry sulphur.	Dust at first indication.	Lime-sulphur spraying for curl leaf helps control mildew.
Black peach aphis.	Nicotine sulphate 1 pint, fish-oil soap 5 lb., water 100 gal.	As soon as insects appear.	
Black scale, brown apricot scale.	See under apricots.		
Flat headed apple tree borer.	See under apples.		
Peach rust mite.	Lime-sulphur 10 gal., water to make 100 gal.	Dormant season.	
California peach root borer.	Apply 1 to 1½ oz. P. D. B. per tree at base about 3 in. from trunk and mound with earth.	September-October.	Soil should be above 55° F. for best results.
Peach twig borer.	Lime-sulphur 10 gal., basic arsenate of lead 3 lb., water to make 100 gal.	Pink bud stage.	Clean up around packing house. Burn old prunings. Spray must cover all young growth.
Curl leaf.			Spring spraying for blight and twig borer controls curl leaf.
Red spider.	See under almonds.		
San Jose scale.	See under apples.	December to February.	

PEARS

For Control of.	Treatment.	Time of Application.	Remarks.
Black end.	No remedy known.		Seems to be associated with Japanese rootstocks.
Pear blight.	Spraying ineffective. Cut out affected parts. Remove holdover cankers in large branches, trunk and roots during winter. Disinfect tools and cuts with mercuric chloride and mercuric cyanide 1 part each to 500 of water. New cankers on large branches may be cured with zinc chloride solutions. (See footnotes.)		Avoid stimulating rank growth. Topwork on resistant varieties. Inspect orchard frequently during spring and fall.
Scale insects.	See under apricots.		
Pear slug.	See under cherries.		
Codling moth.	See under apples.		
Fruit tree roller, green apple aphis.	See under apples.		
Italian pear scale.	Crude oil emulsion.	January or February.	Drench branches and trunk.
Pear leaf blister mite.	Lime-sulphur 10 gal., water to make 100 gal.	November or February.	The November spray is most successful.
Pear root aphis.	P. D. B.	Fall.	
Pear thrips.	Spray with distillate emulsion 5 gal., nicotine sulphate ½ pint, water to make 100 gal.	As soon as black thrips appear in blossom buds. Again if necessary.	Winter cover crop if not plowed under too early keeps thrips in ground until after blossoming season.
Red humped caterpillar.	See under prunes.		
San Jose scale.	See under apples.		Controlled by the spray for Italian pear scale.

(Concluded on page 26.)

Stationary Spraying Plants

(Continued from page 5)

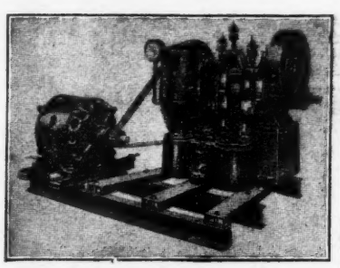
this fact. With the increased pump capacity and much higher pressure required of the large stationary outfits, it is absolutely necessary to provide a substantial foundation. Slight misalignment of the pump with the tank will also cause trouble in bearings and agitator. Shifting of the foundation may break a suction line and cause expensive delay.

In making concrete for foundations of this sort, a common formula is one part cement, two parts good, clean sand and four parts gravel used for concrete purposes. When crushed rock is substituted for gravel, the mixture should be one part cement, one and one-half parts sand and four parts crushed rock. Thorough mixing is essential in this case. The inside of a concrete tank is much easier to clean if it is rubbed smooth, which is sometimes called a floated finish.

Within the limited space for these articles, it will not be possible to give in great detail all the suggestions which a fruit grower should have when he intends to install a plant of his own. Such readers should write to the Agricultural Experiment Station, Berkeley, Calif., for Bulletin 406 on stationary spray plants, by Moses and Duruz; also to the Agricultural Experiment Station, Pullman, Wash., for General Bulletin 212, by Garver.

Spray Pumps

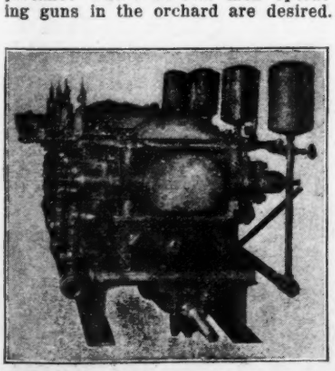
The fruit grower who plans to install this system will greatly increase



A 16-gallon pump and five horsepower electric motor. This outfit is satisfactory for stationary plants in orchards under 10 acres in size

his chances for success if he selects a heavy duty, high pressure spray pump, manufactured by firms specializing in this field. The construction of this most essential part of the equipment is so different from the ordinary well pump, that men who have given many years of study to such outfits, naturally build a far superior pump. Pumps which have served the grower in excellent fashion on a portable outfit may be disappointing in a stationary plant, as the pressure requirements are much higher than in the other case. This practically eliminates the substitution of the used portable outfit in a stationary system when the pipe lines to the remote parts of the orchard are long.

Capacity of pumps is also of importance where several men operating guns in the orchard are desired.



A battery of four 25-gallon per minute pumps for installation in large orchards. Each unit can be operated independently if desired

Pumps vary in capacity from the ordinary portable outfit of nine gallons per minute all the way to 40 gallons per minute. These pumps are usually of the three cylinder type and give more constant pressure than the duplex or one cylinder types, but are not quite so smooth as the four cylinder.

Motors

The majority of orchards do not have electric power available and so the common source of power is a gasoline engine. Where the requirements are 10 horsepower or above, four cylinder engines are giving the best results. But men who are mechanically inclined and ingenious have been able to utilize second-hand gas motors varying in type from the common stationary to the automobile engine. Larger pumps require tractor engine power, as we shall see in a later detailed description. It is not advisable for every grower to attempt to save money in this direction, because an assembled spray outfit with the motor of one type, a pump of another and fittings intended for other uses is not likely to be a success unless the man is unusually apt in a mechanical way. It has been the observation of the writer that even expert mechanics have failed to get results from assembled outfits, which can be obtained with the unit built throughout for spraying purposes. All gasoline engines used for spraying will need a good, sensitive governor to control speed when nozzles are closed and the tank is empty.

Electric motors are easy to operate and offer a smooth flow of power. Considering the long life of the system, they are probably more economical than other kinds of power.

Power is transmitted to the pumps in three ways. Pulleys and belt may be used, as in the case of tractors. However, this proved to be the only use for belts in a study made by Garver on 60 plants. Geared connections from engine to pumps are frequently found, but some popular makes of spray machines now carry silent roller chains and sprockets. The latter type of connection is probably the most expensive, but is giving much satisfaction.

(The second installment of this article will appear in the March issue.)

Dishonest Papa

"There goes the old rascal who swindled me out of $40,000."

"How did he do it?"

"He refused to let me marry his daughter."—*Der Brummer, Berlin.*

(Continued from page 24)

PLUMS AND PRUNES

For Control of.	Treatment.	Time of Application.	Remarks.
Brown rot.	See under apricots.		Sometimes serious on sugar prunes.
Scale insects.	See under apples.		Italian pear scale often serious.
Cherry fruit sawfly.	See under cherries.		
Flat headed apple tree borer.	See under apples.		Often serious on young trees.
Fruit tree leaf roller.	See under apples.		
Mealy plum louse.	1½% summer oil.	When insects appear.	Spraying must be done before leaves curl. Winter spraying for scales also kills eggs on trees.
Peach twig borer.	See under peaches.		
Pear thrips.	See under pears.		
Red humped caterpillar.	Dust with mixture of equal parts arsenate of lead and hydrated lime.	Whenever insects appear. Young caterpillars killed more easily than old ones.	
Tussock moth.	See under apples.		
Red spider.	See under almond.		

WALNUTS

For Control of.	Treatment.	Time of Application.	Remarks.
Blight.	No specific remedy. Plant resistant varieties.		Control of aphids helps.
Codling moth.	(1) Basic arsenate of lead 3 lb., water 100 gal. (2) Dust with arsenate of lead 50%, hydrated lime 50%.	When first observed in May and June.	Time of spraying depends on climatic conditions.
Red humped caterpillar.	See under prunes.		
Walnut aphis.	Dust with 2% nicotine dust.	Last of May or first of June.	Second application often necessary in July or August.

CURRANTS AND GOOSEBERRIES

For Control of.	Treatment.	Time of Application.	Remarks.
Mildew.	Lime-sulphur 3 gal., water to make 100 gal.	As buds begin to open and 2 or 3 times thereafter at 2-week intervals.	In California a dormant spray of lime-sulphur 10 gal., water to make 100 gal., followed by dusting with sulphur often effective.
Currant and gooseberry fruit fly.	Spraying ineffective. Cultivate thoroughly in winter and spring.		
Imported currant borer.	Spraying ineffective. Cut out and burn infested canes.		
Red spider.	Wettable sulphur 5 lb., water 100 gal.	When mites appear.	

BRAMBLES (BLACKBERRIES, RASPBERRIES)

For Control of.	Treatment.	Time of Application.	Remarks.
Cane blight, leaf spot.	(1) 5-5-50 Bordeaux; or lime-sulphur 10 gal., water to make 100 gal.	During dormant season.	Cut out and burn infected parts, renew old plantings.
Anthracnose.			Control measures not yet worked out for California conditions.
Orange rust.	Cut off diseased parts and burn. Dormant spray with Bordeaux or lime-sulphur recommended for trial.		
Raspberry horntail.	Cut off young tips as soon as wilting is noticed. Remove dead canes in winter. Dig out borers.		
Rose scale.	Distillate oil emulsion or miscible oil.	Dormant season.	Lime-sulphur also gives some control.
Red berry mite.	(1) Lime-sulphur 10 gal., water to make 100 gal. (2) Wettable sulphur 5 lb., water 100 gal.	(1) When growth starts in spring. (2) Summer.	Only serious on Himalaya variety.

STRAWBERRIES

For Control of.	Treatment.	Time of Application.	Remarks.
Leaf spot.	5-5-50 Bordeaux	Dormant season.	Clean up and burn leaves in fall.
Strawberry aphis.	5% nicotine dust.	When aphids appear.	Apply dust to underside of leaves.
Strawberry crown moth.	Spraying ineffective. Remove and burn infested plants. Plant only clean stock.		
Strawberry leaf beetle.	Spray with basic arsenate of lead 3 lb., water 100 gal.; or dust with arsenate of lead 20%, hydrated lime 80%.	When pest is discovered.	Infested plants should be destroyed.
Red spider.	White lubricating oil emulsions.	When mites appear.	Avoid use of sulphur dusts or sprays.
Yellows.	Difficult to control. See your farm adviser or county horticulturial commissioner.		

FIGS

For Control of.	Treatment.	Time of Application.	Remarks.
Souring.	Disposal of all fruits in which insects breed and winter.		Caused by yeasts carried into fruits by insects.
Soft rot.			Fungus carried by the fig wasp. Disinfected Capra figs are being used as source of fig wasp for cross-pollinating.
Splitting.			Due to climatic and soil moisture conditions.
Mediterranean fig scale.	Refined commercial oil (miscible or emulsion) 5 to 6 gal., water to make 100 gal.	Dormant season.	These scales resemble oyster shell scales and infest limbs, twigs, leaves and fruit.
Nematodes.	No remedy known.		Becoming serious in some sections.
Smut.	No remedy known.		

FOOTNOTES

Arsenate of Lead—These directions are based upon powdered arsenate of lead; if the paste form only is available, use double the amount.

Lime-Sulphur—These recommendations are based on commercial lime-sulphur solution concentrate testing 32 to 33 degrees Baume.

Refined Oils—Commercial emulsions and miscible oils are made from either heavy or light refined oils.

Wettable Sulphur—Commercial wettable sulphurs are the most satisfactory.

P. D. B.—Paradichlorobenzene, a soil fumigant on the market in the form of white crystals.

Zinc Chloride Solutions—A new formula for treating pear blight cankers. Consult your county farm adviser or horticultural commissioner.

Summer Oils—Specially prepared refined oils for summer use, on the market as emulsions.

Disinfectants—Use cyanide of mercury and bichloride of mercury, 1 part each to 500 parts water.

Bordeaux-Oil Paint—Stir raw linseed oil into any one of the Bordeaux powders found on the market. This makes a durable disinfectant paint.

Effect of Arsenical Sprays on Oranges

By Lon A. Hawkins and W. R. Barger
United States Bureau of Plant Industry

IN 1893, W. S. Hart reported to the Florida State Horticultural Society that spraying oranges with a mixture of bisulphate of soda and arsenate of lime would tend to produce a sweet orange early in the fall. This method of treatment apparently originated with the Rev. Lyman Phelps, who is said to have first used a mixture of London purple and bisulphate of soda for this purpose. Since that time, arsenicals have been used to influence the ripening of citrus fruits from time to time, both in Florida and California.

In 1922, the writers took up a study of this problem and the results obtained in this experimental work corroborated the results obtained by Gray and Ryan of California that soluble arsenical sprays may markedly influence the composition of citrus fruit. In most cases, the change in composition seems to be in a rapid reduction in the acidity of fruit without much change in the sugar content. This results in a fruit, the juice of which will have about the normal specific gravity, but due to the reduction in acidity, it will have a very high soluble solids-acid ratio.

Fruit sprayed once in April has been found to have an acid content of 0.197 per cent with solids-acid ratio of 51.2 to 1 on November 3 of the same year, while soluble solids-acid ratios of from 20 to 40 to 1 were not at all uncommon. The normal soluble solids-acid ratio of unsprayed fruit from the same grove as shown by determination made at the same time was around 7 to 8 to 1.

The effect of the arsenical spray is not confined wholly to the crop to which it is applied. A considerable decrease in the soluble solids-acid ratio of fruit has been noted on fruit the year after spraying, that is, the crop set on the trees after the arsenical spray was applied.

The decrease in acidity with the comparatively normal sugar content of the juice is liable to give the orange a flat, insipid taste. The fruit with a high soluble solids-acid ratio, say about 16 to 18 to 1, will lack the sprightly flavor, attractiveness, and dessert quality that is found in an orange with a soluble solids-acid ratio of 8 to 10 to 1. The marketing of any considerable quantity of fruit with this flat, insipid flavor so that the retailer or consumer begins to expect it in certain brands or from certain localities is liable to react very strongly against such fruit.

Promiscuous use of arsenical spray, either home mixed or proprietary sprays, is liable to lead to a fruit of low dessert quality and a demoralization of the market for the really high grade attractive fruit from the same region. Arsenical sprays are apparently a very powerful stimulant to oranges and unless applied with care are liable to lead to very unfortunate results.—*Sealed-Sweet Chronicle.*

Spraying and Dusting Calendar for Florida

By W. L. Floyd, University of Florida

ALL SPECIES OF CITRUS

Time of Application.	Materials to Use.	For Control of.	Remarks.
(1) When first spring growth appears.	Nicotine sulphate 1 pint, soap 5 lb., water to make 100 gal.	Aphids.	Bend over and dip ends of branches in a bucket containing the solution.
(2) Ten to 15 days after No. 1.	Dust with lime 97%, nicotine sulphate 3%.	Aphids.	Apply in calm weather to infested new growth.
(3) When fruit is 1 in. in diameter.	2½ lb. dry soda sulphur in 100 gal. oil emulsion containing 1% oil (see General Remarks).	White fly, scale insects, rust mites.	Oil emulsion sometimes injures small fruit.
(4) About June, during dry weather.	Dust with flowers of sulphur; or spray with lime-sulphur 2 gal., water to make 100 gal.	Rust mites, red spider.	Watch for mites; apply before they become numerous.
(5) Early in June after rainy season begins.	Parasitic fungi, such as Red Aschersonia and red-headed fungus.	White fly, scale insects.	Dissolve spores off in water, strain and apply with a clean hand sprayer.
(6) October or November.	2½ lb. dry soda sulphur in 100 gal. oil emulsion containing 1% oil (see General Remarks).	White fly, scale insects, rust mites.	The clean-up spray for the year.

GRAPEFRUIT AND SATSUMAS

Time of Application.	Materials to Use.	For Control of.	Remarks.
(1) Soon after petals have fallen.	3-3-50 Bordeaux plus oil emulsion to give 1% oil to mixture (see General Remarks).	Scab, melanose.	To prevent or check these diseases on tender growth. If only melanose is present, spray about 1 month later.

SPECIAL TREATMENTS

The following special treatments for citrus fruits are usually unnecessary under normal conditions; they are recommended for use under certain special conditions described in the column headed "Remarks."

Time of Application.	Materials to Use.	For Control of.	Remarks.
(1) Before new growth unfolds.	3-3-50 Bordeaux plus oil emulsion to give 1% oil to mixture (see General Remarks).	Scab.	On young grapefruit and Satsuma trees when much scab is present. Prune out diseased parts as much as possible before spraying.
(2) February and March.	Dust with lime 97%, nicotine sulphate 3%.	Aphids.	Repeat every 4 or 5 days as long as aphids are found.
(3) When about one-half the petals have fallen.	Lime-sulphur 2½ gal., nicotine sulphate 1 pint, water to make 100 gal.	Thrips.	Apply when 25 or more thrips to the blossom are found.
(4) August or September.	Dust with sulphur; or spray with lime-sulphur 2½ gal., water to make 100 gal.	Rust mites, red spider.	May be necessary if weather is dry.
(5) October or November.	Copper sulphate spread like fertilizer about tree; use 2 to 6 lb. per tree, depending on size.	Ammoniation of fruit.	This prevents ammoniation on next crop.

AVOCADOS

Time of Application.	Materials to Use.	For Control of.	Remarks.
(1) March, latter part of blooming period.	3-3-50 Bordeaux.	Scab.	
(2) About three weeks after No. 1.	3-3-50 Bordeaux.	Black spot.	
(3) About three weeks after No. 2.	3-3-50 Bordeaux.	Blotch.	
(4) October. As foliage begins to harden.	Oil emulsion containing 1% oil (see General Remarks).	Scale insects, white fly.	Alternate with No. 5.
(5) November to March, when pests are present.	Lime-sulphur 1⅔ gal., nicotine sulphate 1 pint, water to make 100 gal.	Leaf thrips, lace bugs, red spider.	
(6) When trees are in bloom.	Nicotine sulphate 1 pint, soap 5 lb., arsenate of lead 3 lb., water to make 100 gal.	Flower thrips, blossom anomala, leaf roller.	Unless thrips are numerous, omit nicotine sulphate and soap.

MANGOES

Time of Application.	Materials to Use.	For Control of.	Remarks.
(1) When in bloom.	Arsenate of lead 3 lb., 3-3-50 Bordeaux 100 gal.	Anthracnose, blossom anomala.	
(2) November to March, when pests are present.	Lime-sulphur 1⅔ gal., nicotine sulphate 1 pint, water to make 100 gal.	Red spider, leaf thrips.	Repeat as often as necessary.
(3) December to February where trees are dormant.	Oil emulsion 1½ gal., water to make 100 gal. (see General Remarks).	Scale insects.	Alternate with No. 2.

GENERAL REMARKS

Arsenate of Lead—The directions in these schedules are based upon powdered arsenate of lead; if the paste form is used, double the amount.

Lime-Sulphur—The directions in these schedules are based upon the use of lime-sulphur concentrate testing 32 to 33 degrees Baume.

Oil Emulsion—The directions in these schedules for oil emulsions are based upon the use of the government formulas. Directions for preparing oil emulsions according to these formulas are presented elsewhere in this issue.

Spraying Schedule

By Brooks D. Drain,

APPLES

Time of Application.	Materials to Use.	For Control of.	Remarks.
(1) Delayed dormant. Early spring as buds are breaking.	Lubricating oil emulsion 4 to 5 gal., water to make 100 gal. (3% actual oil); or lime-sulphur 12 gal., 40% nicotine sulphate ¾ pint, water to make 100 gal.	San Jose scale, European red mite (eggs), aphis, blister mite.	Lubricating oil emulsion is cheaper than lime-sulphur and is more efficient in controlling European red mite.
(2) Pre-pink. Before the clusters of blossom buds separate.	Lime-sulphur 2 gal., water to make 100 gal.	Apple scab.	Used on McIntosh and other varieties subject to scab. Very effective when weather conditions are bad at this season.
(3) Pink spray. As blossom buds begin to show pink.	Lime-sulphur 2 gal., arsenate of lead 3 lb., nicotine sulphate 1 pint, water to make 100 gal.	Red bug, scab, curculio, aphis, tent caterpillar, bud moth, brown tail moth, gypsy moth, canker worms.	In areas where the gypsy moth is troublesome, the amount of arsenate of lead is doubled. This is a very important spray in New England.
(4) Calyx. Within a week after the petals fall.	Lime-sulphur 2 gal., arsenate of lead 3 lb., nicotine sulphate 1 pint, water to make 100 gal.	Codling moth, curculio, scab, red bug, aphis gypsy moth, skeletonizer.	Generally regarded as the most important single spray.
(5) About July 1.	Lime-sulphur 2 gal., arsenate of lead 3 lb., water to make 100 gal.	Railroad worm, Brooks spot, sooty fungus, scab, skeletonizer.	Especially important in the control of railroad worm. Special sprays a and b, noted below, are often substituted for this application where railroad worm has not been common.

NOTES

1. **Special Sprays.**—The following special sprays are sometimes applied in addition to those listed above, or one or more of them may be substituted for No. 5:

a. Where plum curculio is serious on apples, a spray of arsenate of lead 3 lb. to 100 gal. is applied a week or 10 days after the calyx spray. This is also effective against late emerging codling moth. If scab is developing, 2 gal. lime-sulphur are added.

b. In seasons or localities where sooty fungus is expected to be serious, a spray of lime-sulphur 2 gal. to 100 gal. is made about the last of July or 2 months after the calyx spray.

2. Dry lime-sulphur is being commonly used by small growers because of its convenience in handling.

3. Dust is not very generally used with apples in New England, except to supplement liquid spray for mid-summer applications.

SOUR CHERRIES

Time of Application.	Materials to Use.	For Control of.	Remarks.
(1) Immediately after the blossoms fade.	Lime-sulphur 2 gal., arsenate of lead 3 lb., water to make 100 gal.	Brown rot, leaf spot, curculio.	Nicotine sulphate, 1 pint in 100 gal. of solution, may be added if aphids are numerous.
(2) Just after the shucks fall.	Lime-sulphur 2 gal., arsenate of lead 3 lb., water to make 100 gal.	Brown rot, leaf spot, curculio.	Very important in brown rot and curculio control.
(3) Just before the fruit turns red.	Lime-sulphur 2 gal., water to make 100 gal.	Brown rot, leaf spot.	Too late applications will show on the ripe fruit.
(4) Immediately after the fruit is picked.	Lime-sulphur 2 gal., water to make 100 gal.	Leaf spot.	Important in the control of leaf spot.

PLUMS (Japanese Varieties)

(See Note 2 for European varieties.)

Time of Application.	Materials to Use.	For Control of.	Remarks.
(1) Just as shucks begin to fall.	Dry-mix sulphur lime 25 lb., arsenate of lead 3 lb., water to make 100 gal.; or arsenate of lead 3 lb., 8-8-50 self-boiled lime-sulphur 100 gal.	Brown rot, curculio, leaf spot.	A dust of sulphur 85 parts, arsenate of lead 15 parts, may be used.
(2) Ten days to 2 weeks after No. 1.	Dry-mix sulphur lime 25 lb., arsenate of lead 3 lb., water to make 100 gal.; or arsenate of lead 3 lb., 8-8-50 self-boiled lime-sulphur 100 gal.	Curculio, brown rot, leaf spot, skeletonizer, mildew.	Important in curculio control. The same dust materials as for No. 1 may be used.
(3) About July 1.	Dry-mix sulphur lime 25 lb., arsenate of lead 3 lb., water to make 100 gal.; or arsenate of lead 3 lb., 8-8-50 self-boiled lime-sulphur 100 gal.	Curculio, brown rot, leaf spot, skeletonizer, mildew.	Sulphur dust may be used.
(4) Two to 4 weeks after No. 3.	Dry-mix sulphur lime 25 lb., water to make 100 gal.; or 16-16-100 self-boiled lime-sulphur.	Brown rot, leaf spot, mildew.	Should not be used on early ripening varieties. Sulphur dust may be used.

NOTES

1. If European red mite eggs and San Jose scale are present, a special spray of lubricating oil emulsion, 4 to 5 gal. to 100 gal. of water, should be applied when the trees are dormant.

2. Lime-sulphur, 2 gal. to 100 gal. of water, may be substituted in place of the dry-mix or self-boiled lime-sulphur with European varieties as Bradshaw and Lombard. No. 1 spray should then be applied in the pre-blossom stage.

Prize Offered for Label Design

THE GEORGIA Peach Growers' Exchange, Macon, Ga., is offering a prize of $100 to the person submitting the best copyright label for its products.

The design should not contain pictures of peaches or any other fruit but must be appropriate for a wide assortment of fruits and vegetables handled by the exchange. The dimensions are given as six inches either way, and the design will be placed on all quality products marketed.

A special committee has been appointed to take charge of the contest. Anyone in the United States may submit a name and design. The winning design will be copyrighted and will be reproduced on stickers, stencils, etc., for use on the packages of the exchange.—*J. H. Reed, Georgia.*

A BEETLE has recently been damaging furniture in various parts of Los Angeles county, California. Investigation showed the insect to be one of the powder-post beetles, a slender brownish insect which has the habit of mining seasoned wood of oak, hickory, eucalyptus, etc., and is common in California and Oregon.

Infested furniture can be successfully treated by fumigating with hydrocyanic-acid gas in a room heated to 49 degrees Centigrade, or by repeated painting of the furniture with kerosene.

for New England

Massachusetts Agricultural College

GRAPES

Time of Application.	Materials to Use.	For Control of.	Remarks.
(1) As the buds are opening.	Arsenate of lead 3 lb., 4-4-50 Bordeaux 100 gal.	Flea beetle.	Flea beetle injury to the buds at this time will seriously decrease the crop.
(2) When the shoots are 8 to 12 in. long; before the flower buds open, but after the flower clusters are well formed.	Arsenate of lead 3 lb., 4-4-50 Bordeaux 100 gal.	Black rot, mildew (downy), anthracnose, flea beetle,	
(3) Just after the blossoms have faded.	Arsenate of lead 3 lb., 4-4-50 Bordeaux 100 gal.	Black rot, mildew (downy), anthracnose, flea beetle, and berry moth.	Most important single spray.
(4) Ten days to 2 weeks after No. 3.	Arsenate of lead 3 lb., nicotine sulphate 1 pint, 4-4-50 Bordeaux 100 gal.	Black rot, mildew (downy), anthracnose, flea beetle, berry moth, leaf hopper nymphs.	
(5) Two weeks after No. 4.	4-4-50 Bordeaux.	Black rot, mildew (downy).	

NOTE

Additional applications of Bordeaux mixture may be necessary if wet weather prevails.

PEACHES

Time of Application	Materials to Use.	For Control of.	Remarks.
(1) Dormant spray. In late autumn or early spring before buds begin to swell in the least.	Lime-sulphur 7 gal., water to make 100 gal.	Leaf curl.	If San Jose scale is present, use 12 gal. lime-sulphur instead of 7.
(2) When blossoms show pink.	Dry-mix sulphur lime 25 lb., water to make 100 gal.; or 8-8-50 self-boiled lime-sulphur.	Brown rot.	Sulphur dust may be used for this application.
(3) When the shucks are falling.	Dry-mix sulphur lime 25 lb., arsenate of lead 3 lb., water to make 100 gal.; or arsenate of lead 3 lb., 8-8-50 self-boiled lime-sulphur 100 gal.	Brown rot, curculio, scab.	The most important single spray. Sulphur-arsenate of lead dust may be used.
(4) Ten days or 2 weeks after No. 3.	Dry-mix sulphur lime 25 lb., arsenate of lead 3 lb., water to make 100 gal.; or arsenate of lead 3 lb., 8-8-50 self-boiled lime-sulphur 100 gal.	Curculio, scab, brown rot.	Sulphur-arsenate of lead dust, 85 to 15, may be used.
(5) Three or 4 weeks after No. 4.	Dry-mix sulphur lime 25 lb., water to make 100 gal.; or 8-8-50 self-boiled lime-sulphur.	Brown rot, scab.	Should not be used on early ripening varieties. Sulphur dust may be used.

PEARS

Time of Application.	Materials to Use.	For Control of.	Remarks.
(1) Cluster bud spray. As the blossom buds are separating in the cluster.	Lime-sulphur 12 gal., water to make 100 gal.	Psylla (eggs), San Jose scale, scab, blister mite.	Very important in psylla control.
(2) Calyx spray. Just after petals fall.	Lime 40 lb., copper sulphate 2 lb., arsenate of lead 3 lb., nicotine sulphate 1 pint, water to make 100 gal.; or dry-mix sulphur lime 25 lb., arsenate of lead 3 lb., nicotine sulphate 1 pint, water to make 100 gal.	Codling moth, scab, psylla, curculio, leaf spot.	Most important single spray. A dust of sulphur 85 parts, arsenate of lead 15 parts, may be used. Then follow with a 2% nicotine dust for psylla.
(3) Three to 5 weeks after calyx spray.	Lime 40 lb., copper sulphate 2 lb., arsenate of lead 3 lb., nicotine sulphate 1 pint, water to make 100 gal.; or dry-mix sulphur lime 25 lb., arsenate of lead 3 lb., nicotine sulphate 1 pint, water to make 100 gal.	Psylla, scab, sooty fungus, codling moth, other leaf-eating insects and fungous diseases.	Same dust materials as for the calyx application may be used.

SPECIAL SPRAYS

1. A special spray is necessary when blister mites are abundant. Use the same materials as for the cluster bud spray and apply before the buds break. Miscible oil is sometimes used in place of lime-sulphur to prevent psylla egg deposit and where European red mite eggs are present.

2. Emergency sprays for psylla are necessary when the nymphs become abundant. This may occur at almost any time during the growing season. Use same materials as for calyx spray.

GENERAL REMARKS

Arsenate of Lead—The directions in these schedules are based upon powdered arsenate of lead; if the paste form is used, double the amount.

Lime-Sulphur—The directions in these schedules are based upon the use of lime-sulphur concentrate testing 33 degrees Baume.

Oil Emulsion—The directions for oil emulsions are based on the use of the government formulas.

Control of Cherry Maggot

CHERRY MAGGOT may readily be controlled by a timely application of a poison spray, according to the New York Agricultural Experiment Station. The first application should be made to Early Richmonds at about the time the cherries show red on one side, and the second should be applied when Montmorencys show red.

The spray mixture for sour cherries should consist of lime-sulphur two and one-half gallons, arsenate of lead two and one-half pounds and water to make 100 gallons. For sweet cherries, two gallons of lime-sulphur should be used. A 90-10 sulphur-lead-arsenate dust has also given a fair degree of control where foliage and fruit were kept well covered by repeated dusting after heavy rains.

Other helpful measures consist in the use of quick-acting contact insecticides, such as nicotine sulphate; early picking of the entire crop; orchard cultivation to destroy the pupae or resting stage of the maggot; and the removal of crop remains of all kinds. Principal reliance, however, should be placed on the arsenical sprays.

A circular giving fuller details on this question may be obtained from the New York Agricultural Experiment Station, Geneva, N. Y.

The more money spent on better educational facilities, the less is required for correctional institutions.

Spraying Calendar for

By Laval S. Morris,

The Rocky Mountain district is a large one and includes a diversity of conditions. Therefore, it is natural that fruit pests in one locality should present problems different from those of other localities. The codling moth is perhaps the worst enemy of apples in the leading growing sections of this district, but there are a number of localities in which it is unnecessary to spray for this pest. This, of course, may not always be true. In many places, it is unnecessary to apply a dormant spray more often than once in every four or five years; in other sections it would be ruinous not to spray every year.

Certain of the insect and disease pests listed in the spray calendar are troublesome year after

APPLES

What to Spray For.	Treatment.	When to Treat.	Remarks.
Codling moth.	Arsenate of lead 3 lb., water 100 gal.	(1) Immediately after petals fall. (2) Ten days to 2 weeks later. (3) One month later. (4) Later if necessary.	Keep in touch with crop pest inspector as to time of hatching.
Scale insects.	Lime-sulphur 12 gal., water to make 100 gal.; or miscible oil according to directions.	In spring before buds open and in autumn after leaves fall.	If insects are bad in summer, they may be partly checked by light kerosene emulsion.
Fruit tree leaf roller.	Miscible oil for eggs. Arsenate of lead 6 lbs., water 100 gal., for larvae.	Miscible oil in early spring. Lead arsenate when buds are opening.	Codling moth spray helps. Do not spray when trees are in blossom, as honeybees are injured.
Green apple aphis.	Prune infected shoots. Spray with tobacco extract 2 pints, water 100 gal.	When insects appear and before leaves curl. Prune after leaves curl.	Kerosene emulsion and soap solution are recommended also.
Apple curculio.	Destroy hibernating places. Cultivate soil. Spray with arsenate of lead 3 lb., water 100 gal.	Spray after petals fall.	The spray for codling moth will control this insect. In some cases it will be well to destroy wild hawthornes.
Apple leaf hopper.	Nicotine sulphate 1 pint, water 100 gal. Dip nursery stock in soap solution.	Early in season before wing stage appears.	The insects stay under surface of leaves, therefore spray the under surface.
Bud moth.	Arsenate of lead 3 lb., water 100 gal.	When buds are bursting.	This insect has been reported in the northern end of the district only, but is spreading.
Leaf blister mite.	Lime-sulphur 9 gal., water to make 100 gal.; or miscible oil 6½ gal., water to make 100 gal.	Dormant season until buds open.	This insect lives under a blister on the leaves and cannot be treated in the summer.
Apple-tree borers. 1. Round headed. 2. Flat headed.	Keep trees vigorous. Prevent egg laying on trunks by painting with pure white lead and linseed oil.	Paint before June 1. Dig larvae out before they enter the heart wood.	Carbon disulphide may be effective by injecting into hole and plugging up.
Fire blight.	See under pears.		
Blue mold.	Avoid bruising and wounding apples. Do not pile apples in storage. (Keep storage temperature low, 30° to 33°.)	When picking and storing.	Blue mold is a storage disease and does much damage under improper conditions.
Apple scab.	Lime-sulphur 2¼ gal., water to make 100 gal.; or copper sulphate 9 lb., water 100 gal.	Just before buds open.	This disease is not very troublesome in the dry climate of the Rocky Mountain region.
Black rot.	Cut out infected branches. Spray with 4-4-50 Bordeaux.	(1) Middle of July. (2) About two weeks later.	This disease has become serious only of late.

PEARS

What to Spray For.	Treatment.	When to Treat.	Remarks.
Pear or cherry slug.	Arsenate of lead 3 lbs., water 100 gal.; or nicotine sulphate 1 pint, water 100 gal.	When insects appear.	This insect can be controlled by contact spray as well as stomach poison.
Leaf blister mite.	Same as for apples.		
Codling moth.	Same as for apples.		
San Jose scale.	Same as for apples.		
Fire blight (pear blight).	Prune out infected branches, making cuts well below darkened area. Sterilize tools and wounds with mercuric cyanide. Avoid too rapid growth.	In winter and in summer when infected branches are observed.	This disease has exterminated many Bartlett pear orchards in this region. Planting resistant varieties is recommended.

PEACHES

What to Spray For.	Treatment.	When to Treat.	Remarks.
Peach tree borer.	Apply 1 oz. P. D. B. at base of tree. For trees under 6 years, use less.	Early September.	Digging out larvae is not practical.
Peach twig borer.	Lime-sulphur 10 gal., arsenate of lead 3 lb., water to make 100 gal.	Use lime-sulphur in spring before buds burst. Arsenate of lead as buds are bursting and as fruit is maturing if insects are numerous.	Trees kept in a vigorous condition are not bothered much.
Green peach aphis.	Tobacco solution 2 pints, water 100 gal.	As soon as insects appear in spring or early summer.	This insect spreads to other crops, hence spray before migration.
Black peach aphis.	Dip nursery stock in strong tobacco solution. Spray leaves with tobacco solution. Apply tobacco solution or tobacco dust at base of tree and on exposed roots.	To nursery stock when planted. Spray leaves when aphids appear. Treat roots in early summer.	This insect does most damage to the roots. Some aphids, however, attack the leaves during the early growing season. Tobacco dust is effective on moist soil but not on the leaves.
California peach blight (fruit spot).	Prune cankers out. Spray with lime-sulphur 1 gal., water to make 100 gal., in dormant season. In growing season, use 6-6-50 Bordeaux; or lime-sulphur 2 gal., water to make 100 gal.	Prune in spring and as cankers appear. Spray as soon as crop is harvested and early in spring.	This disease is prevalent in a few places only.
Peach leaf curl.	Lime-sulphur 12 gal., water to make 100 gal.	Before buds open in spring.	It is very seldom necessary to spray for this disease.
Scab.	Self boiled lime-sulphur 8-8-50.	(1) Four weeks after petals fall. (2) If necessary, 3 or 4 weeks later.	This disease is serious in certain localities.

GENERAL REMARKS

Arsenate of Lead—The directions in these schedules are based upon powdered arsenate of lead; if the paste form is used, double the amount.

Lime-Sulphur—The directions in these schedules are based upon the use of lime-sulphur concentrate testing 32 degrees Baume.

Rocky Mountain Area

Brigham Young University

year only in certain sections. This means, then, that each grower should become familiar with the pests which are especially bad in his section and spray accordingly. This leads to the conclusion that a definite yearly spray program for the Rocky Mountain district is not as practical as a consideration of the individual pests. However, it is recommended that wherever pests are virulent and persistent enough to warrant the application of a certain number of sprays yearly, such a program be carried out.

Fruit growers should be on the alert and study their individual problems, because the degree of attack of pests may vary greatly from year to year.

CHERRIES

What to Spray For.	Treatment.	When to Treat.	Remarks.
Cherry or pear slug.	See under pear.		This insect is extremely injurious and should receive special attention at present.
Black cherry aphis.	See under pear.		
Shot hole disease (leaf blight).	Lime-sulphur 2 gal., water to make 100 gal.	After the fruit has set.	This disease is not serious in the Rocky Mountain district.

PLUMS

What to Spray For.	Treatment.	When to Treat.	Remarks.
Pear or cherry slug.	See under pear.		Plums are practically free from pests in this district.

APRICOTS

What to Spray For.	Treatment.	When to Treat.	Remarks.
Peach twig borer.	See under peach.		

STRAWBERRIES

What to Spray For.	Treatment.	When to Treat.	Remarks.
Strawberry leaf roller.	Arsenate of lead 3 lb., water 100 gal.	When adult moths appear in spring.	If pest is very troublesome, cut vines and burn after harvest.
Strawberry crown girdler.	Rotation of crops. Plow up patch when badly infested.	After crop is harvested.	If insects are not numerous, the patch may be left 3 or 4 years.
Strawberry root aphis.	Scatter straw over plants in early spring and burn. Plow up old infested patches.	After eggs hatch and aphis appear in spring.	Proper rotation of crops will keep this insect fairly well in check.
White grubs.	Proper crop rotation.	When necessary.	If grubs are bad, strawberries should not follow sod.
Chlorosis (yellow leaves).	Plant in soil that does not cause leaves to turn yellow.		The cause of chlorosis is not definitely known.

GRAPES

What to Spray For.	Treatment.	When to Treat.	Remarks.
Grapevine leaf hopper.	Nicotine sulphate 3 pints soap 2 lb., water 100 gal.	Early spring.	Sanitation in cultural methods is very important.
Powdery mildew.	See under pests that feed promiscuously.		
Downy mildew.	Spray with 5-5-50 Bordeaux; or dust with sulphur.	Just before the blossom buds open.	This disease is very seldom virulent in this district.
Crown gall.	Prune out infected branches. Plant resistant varieties. If vines are badly infected, remove and burn them.	Prune during dormant season.	This disease attacks chiefly the European varieties.
Dead arm.	Prune out infected branches. If badly infected, remove vines. Take cuttings from disease-free vineyards.	During growing seasons when effects of disease can be observed.	In pruning, the cuts should be made some distance below infected area. If disease becomes bad, spread may be checked with Bordeaux.
Phylloxera.	Graft European varieties on resistant American stocks.		In many cases, the phylloxera is not bad enough to bother with.

PESTS THAT FEED PROMISCUOUSLY

What to Spray For.	Treatment.	When to Treat.	Remarks.
Buffalo tree hopper.	Clean cultivation. Burn pruned wood.	Cultivate in early spring so as to keep all weeds down. Prune and burn wood in early spring.	This insect does damage to fruit trees by making punctures in which to lay eggs.
Woolly aphis (plant lice).	Nicotine sulphate 1 pint, water 100 gal.; or 15% kerosene emulsion (see General Remarks).	When aphids appear in spring and before leaves curl.	In some cases, it may be well to prune out infected shoots after leaves curl.
Grasshoppers and crickets.	Tear up breeding grounds with disk or spring-tooth harrow. Scatter arsenic-bran mash in infested fields.	When they become numerous.	Traps may be used to good advantage some years.
Clover mite.	Lime-sulphur 12 gal., water to make 100 gal.; or miscible oil according to directions.	During dormant season.	San Jose scale treatment destroys the eggs of this mite. The mite feeds on clover and various fruit trees.
Red spider.	Tobacco solution 2 pints, clear cold water 100 gal.	When spiders first appear.	Cold water or 2 lb. soap to 100 gal. water is sometimes effective; however, tobacco solution is more certain.
Tent caterpillar.	Prune out and burn tent masses. Spray with arsenate of lead 3 lb., water 100 gal.	In early growing season when caterpillars appear.	These insects are fairly well controlled by natural enemies.
San Jose and Putnam's scales.	Lime-sulphur 12 gal., water to make 100 gal.; or miscible oil according to manufacturers directions.		
Powdery mildew.	Dust with sulphur; or spray with Bordeaux.	In summer as disease appears.	This has become especially bad on grapes lately.
Crown gall.	Plant only disease-free stock. Destroy infected stock. Plant only inspected nursery stock.	When planting or when diseased plants are found.	This disease attacks most fruit trees. It has caused considerable damage to cherries lately.

Kerosene Emulsion—Kerosene emulsion is prepared by shaving ½ lb. laundry soap in 1 gal. boiling soft water. When the soap is dissolved, remove the solution from the fire and add 2 gal. kerosene. Agitate violently until the kerosene and soap solution are thoroughly emulsified. This is the stock solution, and it will keep indefinitely if sealed from air. To make a 15% kerosene emulsion, add 1 gal. of the stock solution to 3½ gal. water.

Spray Calendar for Southern California

By E. O. Essig, University of California

TEMPERATE ZONE FRUITS

APPLES

Time of Application.	Materials to Use.	For Control of.	Remarks.
(1) Dormant spray. Before the buds begin to open.	Lime-sulphur 10 gal., water to make 100 gal.; or any of the oil sprays (see General Remarks).	San Jose scale, oyster shell scale.	Use coarse, driving spray.
	Miscible oil or crude oil sprays (see General Remarks).	Fruit tree leaf roller. San Jose scale, oyster shell scale.	Use coarse, driving spray.
(2) Cluster-bud spray. When buds begin to separate, but before they open.	Lime-sulphur 3 gal., basic arsenate of lead 2 lb., water to make 100 gal.; or basic arsenate of lead 2 lb., 4-4-50 Bordeaux 100 gal.	Apple scab, mildew, fruit tree leaf roller, aphis.	Add ½ pint nicotine sulphate when aphids are present.
(3) First codling moth spray. When most of the petals have fallen.	Lime-sulphur 3 gal., basic arsenate of lead 2 lb., water to make 100 gal.; or basic arsenate of lead 2 lb., 4-4-50 Bordeaux 100 gal.	Codling moth, scab, aphis, mildew.	For mildew add 8 lb. sulphur to each 100 gal. For aphis add ½ pint nicotine sulphate. For codling moth repeat in 3 weeks and again in 8 to 10 weeks.

PEARS

Time of Application.	Materials to Use.	For Control of.	Remarks.
(1) Dormant spray. Before the buds begin to open.	Lime-sulphur 10 gal., water to make 100 gal.; or oil sprays (see General Remarks).	San Jose scale, oyster shell scale, Italian pear scale.	Apply spray thoroughly to all parts of the trees.
	Miscible or carbolic oil sprays (see General Remarks).	Mealy bugs.	Scrape bark and make one or more applications of spray.
(2) Cluster-bud spray. When buds begin to separate but before they open.	Lime-sulphur 2½ gal., basic arsenate of lead 2 lb., water to make 100 gal.; or basic arsenate of lead 2 lb., 4-4-50 Bordeaux 100 gal.	Codling moth, blister mite, cankerworms, scab.	For codling moth repeat in two or three weeks.
	Spray with (1) miscible oil 3 gal., nicotine sulphate 1 pint, water to make 100 gal., or (2) highly refined lubricating oil emulsion 4 gal., water to make 100 gal.; or dust with nicotine dust.	Pear thrips.	Repeat applications as necessary.
(3) Fall spray. November.	Lime-sulphur 8 gal., water to make 100 gal.	Pear leaf blister mite.	This is the most important time to spray for this pest. Over-wintering mites frequently kill the buds if spraying is delayed until spring.

APRICOTS

Time of Application.	Materials to Use.	For Control of.	Remarks.
(1) Dormant. Before the buds begin to open.	Lime-sulphur 10 gal., water to make 100 gal.; or 4-4-50 Bordeaux.	Peach blight or shot hole fungus, brown rot.	Spray new growth thoroughly.
	Oil sprays (see General Remarks).	Brown apricot scale.	Spray new growth thoroughly.
(2) When buds are bursting and first few blossoms appear.	Lime-sulphur 10 gal., basic arsenate of lead 3 lb., water to make 100 gal.; or basic arsenate of lead 3 lb., 4-4-50 Bordeaux 100 gal.	Peach twig borer, shot hole fungus or peach blight, leaf curl.	

PEACHES

Time of Application.	Materials to Use.	For Control of.	Remarks.
(1) Dormant spray. Before buds begin to swell.	Lime-sulphur 10 gal., water to make 100 gal.; or 4-4-50 Bordeaux.	Peach blight or shot hole fungus, peach leaf curl.	These sprays are preferably made in November. Bordeaux mixture now preferred in California.
	Lime-sulphur 10 gal., water to make 100 gal.; or oil sprays (see General Remarks).	San Jose scale.	Thoroughly cover entire tree.
(2) When buds begin to swell and the first few flowers open.	Lime-sulphur 10 gal., basic arsenate of lead 3 lb., water to make 100 gal.; or basic arsenate of lead 3 lb., 4-4-50 Bordeaux 100 gal.	Peach blight or shot hole fungus, peach leaf curl, San Jose scale, peach twig borer.	Use Bordeaux in sections where injury is caused by lime-sulphur.
(3) Summer sprays.	Spray with (1) lime-sulphur 2½ gal., water to make 100 gal.; or (2) wettable sulphur (see General Remarks); or (3) highly refined lubricating oil emulsion (see General Remarks); or dust with dry sulphur.	Red spider.	Apply whenever the spider appears and repeat if necessary. Keep soil well supplied with moisture. 2% summer oils have proved very satisfactory.

PLUMS AND PRUNES

Time of Application.	Materials to Use.	For Control of.	Remarks.
(1) Dormant spray. Before buds begin to swell.	Lime-sulphur 10 gal., water to make 100 gal.	Peach blight or shot hole fungus, San Jose scale.	
	Oil sprays (see General Remarks).	San Jose scale, Italian pear scale.	Add 4 lb. caustic soda to remove moss or lichens.
(2) Cluster-bud spray. When buds begin to separate but before they open.	Spray with (1) miscible oil 3 gal., nicotine sulphate 1 pint, water to make 100 gal.; or (2) highly refined lubricating oil emulsion 2 gal., water to make 100 gal.; or dust with nicotine dust.	Pear thrips.	It may be necessary to make added applications when the blossoms open and the fruit is in the jackets.
(3) Summer sprays. When trees are in foliage.	Spray with (1) lubricating oil emulsion 1 gal., water to make 100 gal.; or (2) wettable sulphur (see General Remarks); or (3) lime-sulphur 2½ gal., water to make 100 gal.; or dust with dry sulphur.	Red spider.	Apply when mites appear. Use 2% summer oil until fruit is nearly ¾ mature.
	Highly refined lubricating oil emulsion 2 gal., water to make 100 gal.; or whale oil soap 5 lb., water 100 gal.	Mealy plum louse.	Care must be taken to thoroughly drench the undersides of the leaves.

BERRIES

Time of Application.	Materials to Use.	For Control of.	Remarks.
(1) Cluster-bud spray. When blossom buds are formed and before they open.	Lime-sulphur 2½ gal., water to make 100 gal.; or wettable sulphur (see General Remarks).	Mite causing redberry disease of Himalaya blackberry, Loganberry and Mammoth blackberry	If this application is not made, use wettable sulphur at any time during early summer before berries are half grown.
(2) Summer sprays.	Highly refined lubricating oil emulsion (see General Remarks).	Strawberry aphis, red spider on various berries.	Apply to both surfaces of leaves.

SUBTROPICAL FRUITS AND NUTS

CITRUS FRUITS

Time of Application.	Materials to Use.	For Control of.	Remarks.
(1) Fall, winter and spring.	Fumigate with HCN gas; or spray with highly refined oil emulsion (see General Remarks).	Scale insects.	Spraying must be done thoroughly. Follow recommendations as to dilution and times to apply.
	4-4-50 Bordeaux.	Brown rot.	
(2) Spring, summer and fall.	Spray with (1) lime-sulphur 2 gal., water to make 100 gal.; or (2) wettable sulphur (see General Remarks); or (3) highly refined lubricating oil emulsion (see General Remarks); or dust with dry sulphur.	Red spiders.	Apply as soon as mites appear and as often as necessary.
	Lime-sulphur 2 gal., nicotine sulphate ¾ pint, water to make 100 gal.; or highly refined lubricating oil emulsion (see General Remarks).	Citrus thrips.	Two or more applications may be necessary.

WALNUTS

Time of Application.	Materials to Use.	For Control of.	Remarks.
(1) May, June or July.	Spray with basic arsenate of lead 3 lb., water 100 gal.; or dust with arsenate of lead 15% hydrated lime 85%.	Codling moth.	Begin applications as soon as the work on the green husks appears.
	2% nicotine dust.	Walnut aphis.	When aphis appear.

FIGS

Time of Application.	Materials to Use.	For Control of.	Remarks.
(1) Dormant. Before buds begin to swell.	Lime-sulphur 10 gal., water to make 100 gal.; or oil sprays (see General Remarks).	Fig scale.	

ALMONDS

Time of Application.	Materials to Use.	For Control of.	Remarks.
(1) Dormant spray. Before buds begin to swell.	Lime-sulphur 10 gal., water to make 100 gal.	Red spider eggs, peach blight or shot hole fungus, brown rot, San Jose scale.	
(2) When buds are swelling and first few flowers are opening.	Lime-sulphur 10 gal., water to make 100 gal.	Red spider, peach blight, brown rot, San Jose scale, peach twig borer.	Make thorough applications.
(3) Summer spray. When trees are in foliage.	Spray with (1) highly refined lubricating oil emulsion (see General Remarks); or (2) wettable sulphur (see General Remarks); or (3) lime-sulphur 3 gal., water to make 100 gal.; or dust with sulphur.	Red spider.	When the mites appear in early spring and summer.

GRAPES

Time of Application.	Materials to Use.	For Control of.	Remarks.
(1) Early spring. When new shoots are 6 to 8 in. long and again when fruit is the size of buckshot.	Dust with dry sulphur.	Mildew.	Make one or two applications.
(2) Spring and summer.	Spray with nicotine sulphate ½ pint, hard soap 1 lb., water 100 gal.; or dust with 50% calcium cyanide.	Grape leaf hopper.	Apply when nymphs or young first appear.

OLIVES

Time of Application.	Materials to Use.	For Control of.	Remarks.
(1) Winter. During December, January or February.	Oil sprays (see General Remarks).	Ivy scale, black scale.	

GENERAL REMARKS

Arsenate of Lead—The directions in these schedules are based upon powdered arsenate of lead; if the paste form is used, double the amount. If combined with lime-sulphur or Bordeaux mixture, the neutral or basic form is to be preferred. The neutral or basic form should also be used in the fog belt along the coast.

Lime-Sulphur—The directions in these schedules are based upon the use of lime-sulphur concentrate testing 33 degrees Baume. Applications of this material in hot, dry weather should be avoided.

Wettable Sulphur—This material is made of hydrated lime, superfine sulphur and calcium caseinate. Use these materials in the proportions of 8 lb. hydrated lime, 16 lb. superfine sulphur and 1 lb. calcium caseinate. The materials can be mixed dry in advance and stored for use. In preparing the dilute spray, fill the spray tank half full of water, then with agitator running, add the dry material slowly, directing the spray nozzle upon the material until it has disappeared in the water. In the above formulas, 5 lb. of the dry mixture are used for 100 gal. of dilute material.

Oil Sprays—There is a great variety of oil sprays on the market. Growers are advised to consult with their local horticultural commissioner or county agent before buying and using the same, or to follow the manufacturers' directions in regard to dilution.

Nicotine Sulphate—The directions in these schedules are based upon the use of 40% nicotine sulphate.

Dusts—Nicotine dusts and calcium cyanide dusts are available in various strengths. The former are also available in combination with lime, arsenate of lead, etc.

A New Standard for Spray Schedules

(*Continued from page 7*)

Spray service, as at present being developed, takes full advantage of the specialized knowledge which the plant pathologist and entomologist knows how to obtain. To continue using scab as our example, the specialist makes it his business to go into the orchard with his microscope and spore traps and to watch the scab fungus in its winter quarters on the dead leaves. This he does during the early spring, the time when this parasite is actively maturing its spores with which a little later it will produce the dreaded infection on the apple. It is possible for the specialist to keep track of the movements of the enemy over quite a considerable geographical area. When he finds the scab spores are mature in a certain place, he can say to the growers of that region, "*now* is the time." He says this as a result of his observations of the parasite itself and regardless of whether the apple buds are just beginning to break or whether the trees are nearing full bloom.

In order that this service may be still more effective, the weather man is taken into partnership. It becomes his special duty to foretell the periods when rain may be expected. This is a very important point, for even though the scab spores be mature, they will not be discharged and are not in any way dangerous unless it rains. Fortunately, in most regions it is possible for the weather specialist to predict, usually two days in advance, these periods of rainy weather. Local showers are more difficult to predict, but they are not usually of much importance, for it is known that several hours of wetting are necessary for the distribution of scab spores. Now the stage is set, one specialist has learned that the enemy is ready for the attack, another specialist sees the enemy ally, a rainy day coming and the word goes out to growers of that region, by letter, telephone or radio, "spray *now* for apple scab. You have 36 hours in which to protect your orchard." The grower has been waiting for the word. His spray outfits, men and materials are ready. He gets busy without any wasted time or effort and he stops worrying about scabby apples. Such is the spray service, and it is proving so effective for fungous and insect parasites of the apple that at least one state experiment station no longer publishes a schedule of the old kind for apples, feeling that it is destined to become as obsolete as the barrel spray outfit.

Oil Sprays for Deciduous Fruits

(*Continued from page 11*)

this combination is used, especially in the late sprays, provision will have to be made for removing the residue. It is possible that summer oil sprays may be found very useful for late brood codling moth, but experimental work has not gone far enough to make any definite recommendation on this point.

Summary

Summing up the advantages of oil sprays on deciduous fruit trees, we can briefly state the following:

The proper type of oil spray, properly diluted and applied, has given better control of San Jose scale than has been the case with lime-sulphur. These sprays are cheaper than any other of the dormant sprays, and in addition to controlling scale, can, if properly used, be depended upon for control of the fruit tree leaf roller and some other insects. If properly made from the right class of oils, and properly diluted, there is practically no injury to apple or peach where oil sprays are applied in the dormant. For the past five or six years, many commercial orchards have been sprayed with the oil sprays each year without the slightest sign of injury. In the delayed dormant spray, nicotine sulphate may be combined with some of the oil sprays of the first two classes and used at a strength of one to 2000, with very good results against aphids. It will cost only from one-half to two-thirds as much to spray an orchard with the oil sprays as is the case with lime-sulphur. Summer oils are promising, but more experience with this class of sprays is needed before any very definite recommendations can be made.

Mortgage Debt and Taxes Increase

AT A RECENT meeting of master farmers in Oklahoma, Secretary William M. Jardine stated that in 1910 the total mortgage debt on farms operated by owners was two and one-quarter billion dollars. In 1920 it was five and one-half billion dollars, which represented an increase of three billion dollars. The average interest rate was six per cent. The increase in interest charges, therefore, was $200,000,000.

In 1913-14, taxes on farm and land were 31.4 cents an acre. The total tax payment was $276,000,000. In 1921-22, the average was 71 cents an acre, and the total was $678,000,000. The total for 1926 is estimated at $800,000,000. This figure represents an increase of $524,000,000 over tax payments in 1913-14.

Spraying and Dusting

By Oliver I. Snapp, Bureau of Entomology,

SPRAYING PROGRAM FOR PEACHES

Time of Application.	Materials to Use.	For Control of.	Remarks.
(1) During winter when trees are dormant.	Lubricating oil emulsion 3% (see General Remarks); or lime-sulphur 12½ gal., water to make 100 gal. When oil emulsion is used, add 4-4-50 Bordeaux for peach leaf curl in sections where prevalent.	San Jose and other scale insects, leaf curl.	Lime-sulphur solution should not be used on peach trees in the South until after two or three good killing frosts have occurred. The lubricating oil emulsion can be used any time after the leaves fall.
(2) When 75% of the petals (pink part of flower) have fallen.	Arsenate of lead 2 lb., lime water from 6 lb. unslaked lime, water to make 100 gal.	Curculio.	If hydrated lime is used instead of unslaked lime, use 8 lb. to 100 gal. water.
(3) When calyces or "shucks" are shedding or when small peaches are exposed. This is usually about 10 days after the petals fall.	Arsenate of lead 2 lb., lime water from 6 lb. unslaked lime, water to make 100 gal.	Curculio.	If hydrated lime is used instead of the unslaked lime, use 8 lb. to 100 gal. water.
(4) Two weeks after the third application, or about 4 weeks after the petals have been shed.	8-8-50 self-boiled lime-sulphur. (No arsenate of lead is used in this application.)	Scab, brown rot.	If for unavoidable reasons the first spray cannot be applied, use the arsenate of lead in this application with the self-boiled lime-sulphur.
(5) Four weeks before each variety is due to ripen.	Arsenate of lead 2 lb., 8-8-50 self-boiled lime-sulphur 100 gal.	Curculio, brown rot, scab.	This is a very important spray for the second brood of curculio "worms," and must be applied according to the ripening period of each variety. It is, furthermore, the most important application for brown rot control.

DUSTING PROGRAM FOR PEACHES

Time of Application.	Materials to Use.	For Control of.	Remarks.
(1) During winter when trees are dormant.	Lubricating oil emulsion 3% (see General Remarks); or lime-sulphur 12½ gal., water to make 100 gal. When oil emulsion is used, add 4-4-50 Bordeaux for peach leaf curl in sections where prevalent.	San Jose and other scale insects, leaf curl.	Lime-sulphur solution should not be used on peach trees in the South until after two or three good killing frosts have occurred. The lubricating oil emulsion can be used any time after the leaves fall.
(2) When 75% of the petals (pink part of flower) have fallen.	Arsenate of lead 5%, lime 95%.	Curculio.	It is not necessary to use sulphur in this application, although the 80-5-15 dust formula may be used if desired.
(3) When calyces or "shucks" are shedding or when small peaches are exposed. This is usually about 10 days after the falling of the petals.	Arsenate of lead 5%, lime 95%.	Curculio.	It is not necessary to use sulphur in this application, although the 80-5-15 dust formula may be used if desired.
(4) Two weeks after the third application or about 4 weeks after the petals have been shed.	Sulphur 80%, arsenate of lead 5%, lime 15%.	Scab, brown rot.	
(5) Four weeks before each variety is due to ripen.	Sulphur 80%, arsenate of lead 5%, lime 15%.	Curculio, brown rot, scab.	

SPRAYING PROGRAM FOR PLUMS

Time of Application.	Materials to Use.	For Control of.	Remarks.
(1) During winter when trees are dormant.	Lubricating oil emulsion 3% (see General Remarks); or lime-sulphur 12½ gal., water to make 100 gal.	San Jose and other scale insects.	Lime-sulphur solution should not be used on plum trees in the South until after two or three good killing frosts have occurred. The lubricating oil emulsion can be used any time after the leaves fall.
(2) When 75% of the petals have fallen.	Arsenate of lead 2 lb., lime water from 6 lb. unslaked lime, water to make 100 gal.	Curculio.	If hydrated lime is used instead of the unslaked lime, use 8 lb. to 100 gal. water.
(3) When calyces or "shucks" are shedding or when small plums are exposed.	Arsenate of lead 2 lb., lime water from 6 lb. unslaked lime, water to make 100 gal.	Curculio.	If hydrated lime is used instead of the unslaked lime, use 8 lb. to 100 gal. water.
(4) Two weeks after the third application.	8-8-50 self-boiled lime-sulphur 100 gal., calcium caseinate 1 lb.	Brown rot, leaf spot.	For all varieties of plums other than the Japanese, lime-sulphur concentrate, 3 parts to 100 parts water, should be used instead of self-boiled lime-sulphur.
(5) Four weeks before ripening.	8-8-50 self-boiled lime-sulphur 100 gal., arsenate of lead 2 lb., calcium caseinate 1 lb.	Curculio, brown rot, leaf spot.	For all varieties of plums other than the Japanese, lime-sulphur concentrate, 3 parts to 100 parts water, should be used instead of the self-boiled lime-sulphur.

DUSTING PROGRAM FOR PLUMS

Time of Application.	Materials to Use.	For Control of.	Remarks.
(1) During winter.	Lubricating oil emulsion 3% (see General Remarks); or lime-sulphur 12½ gal., water to make 100 gal.	San Jose and other scale insects.	Lime-sulphur solution should not be used on plum trees in the South until after two or three good killing frosts have occurred. The lubricating oil emulsion can be used any time after the leaves fall.
(2) When 75% of the petals have fallen.	Arsenate of lead 5%, lime 95%.	Curculio.	It is not necessary to use sulphur in this application, although the 80-5-15 dust formula may be used if desired.
(3) When calyces or "shucks" are shedding or when small plums are exposed.	Arsenate of lead 5%, lime 95%.	Curculio.	It is not necessary to use sulphur in this application, although the 80-5-15 dust formula may be used if desired.
(4) Two weeks after third application.	Sulphur 80%, arsenate of lead 5%, lime 15%.	Scab, brown rot.	
(5) Four weeks before ripening.	Sulphur 80%, arsenate of lead 5%, lime 15%.	Curculio, brown rot, scab.	

GENERAL

Lubricating Oil Emulsion—The stock lubricating oil emulsion usually contains 66⅔% of oil. Add 4½ gal. of this stock emulsion to 95½ gal. water to make a 3% emulsion.

Arsenate of Lead—The recommendations for arsenate of lead are based on the powdered form; if the paste form is used, double the amount.

Program for Southeast

United States Department of Agriculture

SPRAYING PROGRAM FOR SOUR CHERRIES

Time of Application.	Materials to Use.	For Control of.	Remarks.
(1) During winter when trees are dormant.	Lubricating oil emulsion 3% (see General Remarks); or lime-sulphur 12½ gal., water to make 100 gal.	San Jose and other scale insects.	
(2) When 75% of the petals have fallen.	Arsenate of lead 2 lb., lime water from 6 lb. unslaked lime, lime-sulphur 3 gal., water to make 100 gal.	Curculio, leaf spot.	
(3) Three weeks after the shedding of the petals.	Arsenate of lead 2 lb., lime water from 6 lb. unslaked lime, lime-sulphur 3 gal., water to make 100 gal.	Curculio, brown rot, leaf spot.	
(4) Immediately after fruit is harvested.	Lime-sulphur 3 gal., water to make 100 gal.	Leaf spot.	

SWEET CHERRIES

Sweet cherries should receive the same materials as noted for the sour varieties, except that for the summer sprays the lime-sulphur concentrate should be used in the proportion of 2 gal. to 100 gal. of water.

SPRAYING PROGRAM FOR APPLES, PEARS AND QUINCES

Time of Application.	Materials to Use.	For Control of.	Remarks.
(1) During winter when trees are dormant.	Lubricating oil emulsion 3% (see General Remarks); or lime-sulphur 12½ gal., water to make 100 gal.	San Jose and other scale insects.	In localities where aphids are troublesome this application should be delayed until the green can just be seen in the end of the blossom buds; if aphids are prevalent add 1 pint 40% nicotine sulphate to 100 gal. water.
(2) Immediately after cluster buds have opened.	Arsenate of lead 2 lb., lime-sulphur 3 gal., water to make 100 gal.	Curculio, tent caterpillar, scab, etc.	Add nicotine sulphate if aphids are troublesome. This spray may be omitted on varieties not susceptible to scab.
(3) Immediately after the petals fall.	Arsenate of lead 2 lb., lime-sulphur 3 gal., water to make 100 gal.	Codling moth, curculio, leaf roller, tent caterpillar, scab, etc.	This is the most important application for the codling moth, and the spray should be driven well into the calyx end of the small apples. Avoid over-spraying.
(4) Two to 3 weeks after petals fall.	Arsenate of lead 2 lb., 3-4-50 Bordeaux 100 gal.	Codling moth, leaf roller, scab, leaf spot, blotch, etc.	
(5) Three weeks after fourth application.	Arsenate of lead 2 lb., 3-4-50 Bordeaux 100 gal.	Codling moth, blotch, bitter and black rots.	
(6) Two to 3 weeks after fifth application.	Arsenate of lead 2 lb., 4-4-50 Bordeaux 100 gal.	Codling moth, bitter and black rots, blotch.	
(7) One month before each variety is due to ripen.	Arsenate of lead 2 lb., 4-4-50 Bordeaux 100 gal.	Codling moth, bitter rot.	If bitter rot is severe, apply Bordeaux between sixth and seventh applications at 2 to 3-week intervals.

Note—Summer apples usually need only the first, second, third and fourth applications of the above spray program; however, the latest ripening summer varieties may need the fifth and sixth. Pears and quinces usually require only applications 1, 3, 4 and 6, and Bordeaux mixture may be used in place of the lime-sulphur on these fruits.

SPRAYING PROGRAM FOR GRAPES

Time of Application.	Materials to Use.	For Control of.	Remarks.
(1) During winter when vines are dormant.	Lubricating oil emulsion 3% (see General Remarks); or lime-sulphur 12½ gal., water to make 100 gal.	Scale insects.	
(2) Just before blossoms open.	Arsenate of lead 3 lb., 4-3-50 Bordeaux 100 gal.	Flea beetles, rose chafers, anthracnose, black rot, mildew.	
(3) After blossoms fall.	Arsenate of lead 3 lb., 4-3-50 Bordeaux 100 gal.	Flea beetles, rose chafers, grape leaf folders, anthracnose, black rot, mildew.	
(4) Two weeks later.	Arsenate of lead 3 lb., nicotine sulphate ½ pint, calcium caseinate 1 lb., 4-3-50 Bordeaux 100 gal.	Leaf hoppers, aphids, leaf folders, fungous diseases.	
(5) Two weeks before fruit is due to ripen.	Neutral copper sulphate or basic acetate of copper 2 lb., calcium caseinate 1 lb., water 100 gal.	Black rot, mildew.	

SPRAYING PROGRAM FOR BLACKBERRIES

Time of Application.	Materials to Use.	For Control of.	Remarks.
(1) During late winter just before growth starts.	Lime-sulphur 12½ gal., water to make 100 gal.	Scale insects, anthracnose.	
(2) When new shoots are 6 in. high.	Lime-sulphur 2½ gal., water to make 100 gal.	Anthracnose.	Add arsenate of lead 2 lb. to 100 gal. water if chewing insects are troublesome.
(3) When new shoots are 10 in. high.	Lime-sulphur 2½ gal., water to make 100 gal.	Anthracnose.	Add arsenate of lead 2 lb. to 100 gal. of water if chewing insects are troublesome.
(4) Just before blooms open.	Lime-sulphur 2½ gal., water to make 100 gal.	Anthracnose.	Add arsenate of lead 2 lb. to 100 gal. water if chewing insects are troublesome.

SPRAYING PROGRAM FOR STRAWBERRIES

Time of Application.	Materials to Use.	For Control of	Remarks.
(1) Just before blossoms open.	4-4-50 Bordeaux.	Leaf spot.	
(2) After blossoms open.	4-4-50 Bordeaux.	Leaf spot.	Add 2 lb. arsenate of lead to 100 gal. of spray if leaf rollers or flea beetles are present.
(3) Two weeks later.	4-4-50 Bordeaux.	Leaf spot.	Add 2 lb. arsenate of lead to 100 gal. of spray if leaf rollers or flea beetles are present.

REMARKS

Lime-Sulphur—The recommendations for lime-sulphur are based on the use of concentrate testing 32 degrees Baume.

Recommendations for disease control in above schedules furnished by the Office of Fruit Disease Investigations, Bureau of Plant Industry, United States Department of Agriculture.

New Jersey Fruit Judging Team Wins Championship

THE RUTGERS (New Jersey) fruit judging team again won the championship of the Intercollegiate Fruit Judging League at Amherst, Mass., on December 3. Its score was 93.63 per cent. Pennsylvania State College scored second with 91.45 per cent, and the Massachusetts Agricultural College team was third with 89.78 per cent.

The Rutgers team was composed of H. W. Spector of Trenton, R. M. Bettes of Montclair, and O. A. Deakin of Plainfield. Mr. Spector scored 98 per cent and won a gold medal for the highest individual score. Mr. Bettes won third place with a score of 93.55 per cent and received a bronze medal.

This is the fifth time the New Jersey team has won the championship. It has won one cup permanently. The present cup has been won twice by teams from Purdue University, West Virginia and Rutgers University. Next year's contest should be a strenuous one because these three teams will be striving to gain permanent possession of the trophy.

An American cowboy who was very ill was asked if he had forgiven his enemies. "Enemies?" repeated the puncher, with a faint smile, "I ain't got none. Shot 'em all years ago."

General Spray Table for the Southwest

By W. B. Lanham

APPLES AND PEARS

Time of Application.	Materials to Use.	For Control of.	Remarks.
(1) After leaves have fallen and until growth starts in the spring.	Lime-sulphur 11 gal., water to make 100 gal.; or oil emulsion (see General Remarks).	San Jose and other scale insects.	
(2) When 90% to 100% of petals have fallen; rush to completion.	Arsenate of lead 4 lb., nicotine sulphate 1 pint, water to make 100 gal.	Codling moth, plant lice, curculio, biting insects.	The most important application for codling moth.
(3) Eighteen days after No. 2.	Arsenate of lead 4 lb., 4-4-50 Bordeaux 100 gal.	Codling moth, blotch, curculio, biting insects.	
(4) Six weeks after No. 2.	Arsenate of lead 4 lb., 4-4-50 Bordeaux 100 gal.	Codling moth, blotch, curculio, biting insects.	
(5) Three weeks after No. 4.	Arsenate of lead 4 lb., 4-4-50 Bordeaux 100 gal.	Codling moth, blotch, curculio, biting insects.	
(6) Three weeks after No. 5.	Arsenate of lead 4 lb., 4-4-50 Bordeaux 100 gal.	Codling moth, blotch, curculio, biting insects.	

PECANS

Time of Application.	Materials to Use.	For Control of.	Remarks.
(1) Dormant season.	Oil emulsion (see General Remarks).	Obscure scale.	
(2) When first larvae are seen after nuts are set.	Arsenate of lead 6 lb., water 100 gal.	Nut case bearer.	Add 3 lb. lime if water contains sulphur.
(3) After growth starts and during humid weather.	4-4-50 Bordeaux.	Scab.	
(4) When first worms appear.	Arsenate of lead 4 lb., water 100 gal.	Webb worms.	

GRAPES

Time of Application.	Materials to Use.	For Control of.	Remarks.
(1) After leaves have fallen and before growth starts in the spring.	4-4-50 Bordeaux.	Black rot, mildew.	
(2) When leaves are out 4 to 6 in.	Arsenate of lead 4 lb., 4-4-50 Bordeaux 100 gal.	Black rot, mildew, biting insects.	
(3) Ten days to 2 weeks after No. 2.	Nicotine sulphate 1 pint, 4-4-50 Bordeaux 100 gal.	Black rot, mildew biting insects, sucking insects.	
(4) Two weeks after No. 3.	4-4-50 Bordeaux.	Black rot, mildew.	
(5) Two weeks before harvest if necessary.	4-4-50 Bordeaux.	Black rot, mildew.	

PEACHES, PLUMS AND APRICOTS

Time of Application.	Materials to Use.	For Control of.	Remarks.
(1) After leaves have fallen and until growth starts in the spring.	a. 4-4-50 Bordeaux. b. Oil emulsion (see General Remarks).	a. Peach leaf curl. b. San Jose scale alone.	Both peach leaf curl and scale may be controlled with lime-sulphur 11 gal., water to make 100 gal.
(2) When two-thirds of the shucks are off.	Arsenate of lead 4 lb., 8-8-50 self-boiled lime-sulphur 100 gal.; or arsenate of lead 4 lb., wettable sulphur 100 gal. (see General Remarks).	Brown rot, curculio, scab, biting insects, leaf spot.	
(3) Seven to 10 days after No. 2.	Arsenate of lead 4 lb., 8-8-50 self-boiled lime-sulphur 100 gal.; or arsenate of lead 4 lb., wettable sulphur 100 gal. (see General Remarks).	Brown rot, curculio, scab, leaf spot, biting insects.	
(4) About 4 weeks before ripening.	Self-boiled lime-sulphur; or wettable sulphur (see General Remarks).	Brown rot, scab, leaf spot.	
(5) October 1 to 15 and March 1 to 15.	Paradichlorobenzene in soil (see U. S. Dept. Agr. Bul. No. 1169).	Borers.	
(6) Fall and winter.	Dig worms out.	Borers.	

CITRUS

Time of Application.	Materials to Use.	For Control of.	Remarks.
(1) December and January.	Oil emulsion (see General Remarks).	Scale insects.	
(2) When two-thirds of petals have fallen.	Lime-sulphur 1½ gal., nicotine sulphate 15 oz., water to make 100 gal.	Red spider, thrip, rust mite.	
(3) When fruit is about 1 in. in diameter.	Soda-sulphur 2 gal. (see General Remarks), oil emulsion 1½ gal. (see General Remarks), water to make 100 gal.	Scale insects, rust mite, red scale.	
(4) Ten to 14 days after No. 3.	Spray with lime-sulphur 1½ gal., water to make 100 gal.; or dust with sulphur.	Rust mite, red spider.	
(5) July or August.	Spray with lime-sulphur 1½ gal., water to make 100 gal.; or dust with sulphur.	Scale insects, rust mite, red spider.	

FIGS

Time of Application.	Materials to Use.	For Control of.	Remarks.
As soon as the disease appears, usually about July 15. Repeat every month until September 15.	5-5-50 Bordeaux.	Rust.	If growth is unusually rapid it may be necessary to spray oftener than once a month in order that new growth may be covered with spray material.

GENERAL REMARKS

Arsenate of Lead—The directions in these schedules are based upon powdered arsenate of lead; if the paste form is used, double the amount.

Lime-Sulphur—The directions in these schedules are based upon the use of lime-sulphur concentrate testing 32 degrees Baume.

Oil Emulsion—Either of the following two formulas for making oil emulsion may be employed in making the above spray mixtures:

Cold Stirred Emulsion Stock Solution

Fish-oil soap (preferably liquid)	8 lb.
Paraffin oil	2 gal.
Water	1 gal.

The soap should be placed in a receptacle in which the emulsion is to be made. A pint of oil should be added and stirred vigorously until no free oil is visible. This should be continued until the required amount of oil is used and completely emulsified. The water should then be added slowly in the same manner. This stock solution should be diluted with 200 gal. of soft water, or 1 gal. of this stock solution should be used to 50 gal. of soft water.

Boiled Emulsion Stock Solution

Fish-oil soap (1 gal. liquid)	2 lb.
Paraffin oil	2 gal.
Water	1 gal.

Mix the ingredients together and heat to the boiling point. Then emulsify by pumping and repumping the mixture into itself. Merely stirring is not sufficient. A hand spray or barrel spray pump will serve the purpose. If the solution is too thick at the time it is to be used, bring it to a warm temperature but do not boil. This amount of stock solution should be diluted with 200 gal. of water.

Soda-Sulphur Solution—The following directions for making soda-sulphur stock solution are taken from Farmers' Bulletin 933:

"The main value of the soda-sulphur solution consists in the properties which enable it to be used in combination with the oil emulsions. Owing to the superiority of lime-sulphur solution, the use of soda-sulphur solution alone is not advised. It has a distinct place, however, in forming a good combination spray for white flies, scale insects and mites. It is made as follows:

Stock Solution Formula

Flowers of sulphur	30 lb.
Caustic soda (98%)	20 lb.
Water	20 gal.

"To remove the lumps from the sulphur, place a wire screen over the barrel and rub the sulphur through with the hands, then slowly add about 3 gal. of water and stir so as to form a thin paste. The caustic soda should then be added and the entire mixture stirred vigorously. Some growers add the caustic soda gradually to prevent too vigorous boiling, and others add it all at once with water enough to prevent too vigorous boiling. It is also practicable to dissolve the caustic soda in about 4 gal. of water before it is added to the sulphur. The boiling will be quite violent and it may be necessary to add a gallon or more of water during the process, but whether or not this is necessary can be determined by the operator.

"The main difficulty in making this formula is that too great heat is generated, which liquifies the sulphur before it can be acted on by the caustic. If sediment forms, this has been the cause. To prevent this excessive heat, add more water in the beginning and during the process. After boiling has ceased, add about 16 gal. of water.

"For spraying against red spiders and rust mites, use 1 gal. of this stock solution to 40 gal. of water. When used with the oil sprays, the strength should be a little weaker than if used alone. When so used, dilute 1 gal. to 50 gal. of water. If it is to be used in combination with oil emulsion, it should be added to the tank or barrel of water before the oil emulsion."

To make the soda-sulphur solution combination as given in the spray schedule, add 1½ gal. of the oil emulsion to 100 gal. of the diluted solution.

Wettable Sulphur—Wettable sulphur is made from 8 lb. hydrated lime, 16 lb. superfine sulphur and 1 lb. calcium caseinate to 100 gal. water. The materials can be mixed dry in advance and stored for use. In preparing the spray mixture, proceed as follows: Fill the tank half full of water. Then with agitator running, add the dry material slowly and direct the spray nozzle upon the material until it has disappeared in the water.

Virginia Society Holds One of the Best Meetings in Its History

THE THIRTY-SECOND annual meeting of the Virginia State Horticultural Society was held in Roanoke, Va., December 13-15, and was pronounced by many as the most successful and interesting meeting the society has held for many years. An unusually strong program was provided, with such speakers as N. S. Grubbs, Portland Cement Company; Paul Stark of Apples for Health; Sheldon Funk, Pennsylvania peach grower; F. A. Motz of Blacksburg, Va.; Lloyd S. Tenny, chief of the Bureau of Agricultural Economics at Washington; and Dr. S. W. Fletcher, professor of horticulture at State College, Pa. Dr. Fletcher, in a discussion of "Our Competitors in the Pacific Northwest," with lantern slides, gave one of the most interesting talks that has been heard at a Virginia meeting for some time, and his treatment of the subject brought considerable encouragement to eastern growers.

Wednesday's program included G. S. L. Carpenter, Hancock, Md.; Dr. Fromme of Virginia Experiment Station; J. H. Meek, state director of markets; W. S. Hough of Winchester Field Laboratory; and R. G. Phillips, secretary of the International Apple Shippers' Association. Mr. Phillips ran true to form by delivering an unusually interesting and instructive message. Wednesday night's program included a banquet and entertainment attended by close to 300 growers and their wives. Thursday morning's program was given over largely to growers' discussions. T. B. Byrd of Winchester, manager of the Governor Byrd orchards, spoke on the outstanding weakness in Virginia orcharding by emphasizing the great importance of the soil building process which, if accomplished, would, in his opinion, go a long way towards the insurance of high average annual bearing of apple trees.

Other speakers were R. C. Dingledine of Harrisonburg, E. M. Wayland of Heards, E. D. Nininger of Roanoke and R. J. Rae of Crozet. Tuesday afternoon the meeting was adjourned to the Exhibit Hall, where it was divided into two sections—each in charge of a leader who conducted his respective section from one exhibit to the next, allowing each man in charge four minutes for a discussion of the products on display. This feature proved to be a marked success, and was particularly gratifying to the exhibitors.

The following officers were elected for 1928: President, H. L. Bonham, Chilhowie; vice-presidents, E. D. Nininger, Roanoke; F. A. Motz, Blacksburg; C. Purcell McCue, Greenwood; T. B. Byrd, Winchester; Dr. W. T. Lineweaver, Harrisonburg; and Frank D. Wood, Washington, Va.

The offices of secretary and treasurer are filled by the new board at its first meeting in April, at which time the place for the next meeting also will be selected.

Hearing Held in Canada

A PUBLIC HEARING was held at Ottawa, Canada, on January 24 for the purpose of considering (1) the inspection in Canada of nursery stock imported from the United States; (2) the discontinuance of importation of elms from Europe on account of the elm disease; (3) the stopping of importation of conifers from Europe on account of the nun moth and other noxious diseases; and (4) modifying several regulations already in force.

Spreaders and Codling Moth Control

(*Continued from page 3*)

tree, some parts would of necessity be oversprayed, with the result that many large drops would form on the apples. The advantages to be secured from a spray spreader seemed obvious.

Four Types of Coverages

The various experiments with spreaders made prior to 1922 cannot be discussed in this limited article. We will begin with the fact that commercial casein spreaders were used generally throughout this country in 1922 and 1923 and no marked improvement in control resulted. Among the several possible explanations advanced for this outcome were that (1) the casein acted as an antidote for the arsenic; (2) the lime in the spreader diluted the arsenate of lead, making it less effective; (3) the film cracked due to the growth of the apples and worms entered at the cracks; (4) the spreader was inefficient in forming a complete film over the fruit, and (5) the film produced was too thin.

In order to secure definite information regarding this failure of spreader and regarding the entrance of worms into sprayed apples, the writer conducted various experiments that were different from anything previously attempted in codling moth investigations. We shall confine ourselves in this article to certain experiments with newly hatched codling moth worms. These experiments were performed in the following manner: During July and August, several thousand mature worms were collected from the bands on apple trees. The worms were placed in cages, where they transformed to moths. The moths were transferred to large glass jars, where they deposited many thousands of eggs on the sides of the jars. Unsprayed apples were then brought into the laboratory and their calyx cups filled with shellac. Each was suspended on a piece of thread and made to revolve while being sprayed uniformly with a small atomizer. The atomizer gave a fine, misty spray. Four distinct types of coverages, as shown by the accompanying illustration, were applied; namely, film, overspray, coarse spotted and fine spotted. In the case of the fine spotted coverage, it was the aim to have no spot larger than two millimeters in diameter, or about the size of the head of an ordinary pin. In the case of the coarse spotted coverage, the spray was applied continuously until the drops built up to such a large size they were about to run down. The overspray coverage was effected by applying the spray in sufficient quantity that drops ran down more or less irregularly over the apples. The film coverage was made by adding casein spreader to the spray. Powdered acid arsenate of lead was used in amounts of one-half, two, four, eight and 16 pounds to 100 gallons of water.

As the eggs hatched on the sides of the glass jars containing the moths, the little worms were placed directly upon the sprayed apples.

Fine Spotted Coverage Least Effective

Some very surprising results were obtained. This fact is indicated by the accompanying table, which gives the results of one experiment in which 394 apples and 9850 newly hatched worms were used.

It will be noted that the fine spotted coverage, instead of being the most effective, was decidedly the poorest of the four. The film coverage, in which the apples were covered perfectly with the lead arsenate, gave no better protection than the coarse spotted coverage, excepting at the concentrations of eight and 16 pounds of arsenate of lead to 100 gallons. Equally surprising is the fact that the spray was relatively ineffective in protecting the apples; at the usual concentration of two pounds to 100 gallons, approximately one worm out of three succeeded in entering the apples unharmed.

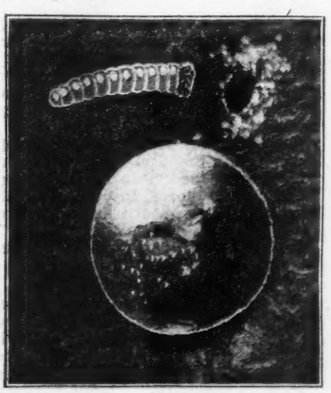
RESULTS FROM DIFFERENT METHODS OF SPRAYING.

Coverage and Concentration	Entrances, Per Cent	Stings, Per Cent	Total Injury, Per Cent
Lead arsenate, ½ lb. to 100 gal.:			
Coarse coverage	57.6	7.2	64.8
Film coverage	55.6	5.8	61.4
Lead arsenate, 2 lb. to 100 gal.:			
Mist coverage	68.4	6.6	75.0
Coarse coverage	31.2	12.6	43.8
Overspray coverage	34.6	14.4	48.9
Film coverage	33.0	13.2	46.2
Lead arsenate, 4 lb. to 100 gal.:			
Mist coverage	54.0	11.2	65.2
Coarse coverage	24.0	19.2	43.2
Overspray coverage	23.3	19.8	43.0
Film coverage	22.0	19.0	41.0
Lead arsenate, 8 lb. to 100 gal.:			
Mist coverage	49.8	12.2	62.0
Coarse coverage	15.6	21.8	37.4
Overspray coverage	15.6	18.6	34.2
Film coverage	10.2	22.2	32.4
Lead arsenate, 16 lb. to 100 gal.:			
Mist coverage	29.2	16.4	45.6
Coarse coverage	9.4	19.0	28.4
Film coverage	2.3	15.8	18.0
Check, unsprayed	79.0	0.4	79.4

Worm Digs Into Apple

An effort was made to find the reasons for such results. It was found that the newly hatched worm makes a very small hole through the skin of the apple; in fact, the hole is about one-twenty-fifth the size of the head of an ordinary pin. This being the case, there was plenty of room for the worms to enter between the deposits of the fine spotted coverage without encountering any poison. Then, also, after we gave a little thought to the matter, it became evident that an apple with a coarse spotted coverage has more of its surface actually covered with the insecticide than the one with a fine spotted coverage. The large spots cover large areas and the spaces between the large spots are covered with innumerable smaller spots.

It was not difficult to find the reason why the worms were able to enter through the film of lead arsenate. In watching a worm making its way through the skin of an apple, one is impressed by the fact that the worm is not eating, but digging. The tiny particles of skin that are cut off by the jaws of the worm are set aside and apparently very little actual feeding takes place until after the worm is well through the skin. The principal shortcoming of spreader is that it produces too thin a film; the film is so thin that the worm does not encounter sufficient insecticide to kill it. It will be noted from the table that as the amount of arsenate of lead was increased, fewer and fewer worms succeeded in entering. Among the many spreader substances that the writer has experimented with, resin fish-oil soap has given a thicker film than anything else.



This highly magnified picture shows the head of an ordinary pin with a newly hatched codling moth nearby and the hole it has started to make. Note that the hole is smaller than the pin head. The light colored substance surrounding the hole consists of particles which the worm cut away with its jaws and cast aside

Ability of Arsenate of Lead to Control Worms

Many people will say that if arsenate of lead will kill only two worms out of each three that attempt to enter a sprayed apple, it is a pretty poor insecticide; but there are a number of things that should be considered before one reaches a conclusion on that question. Many years of experience have proved that spraying with arsenate of lead is of great value in controlling the codling moth. The calyx spray places the insecticide in the calyx cup, and the value of this spray in preventing calyx worms has been well demonstrated. The spring brood of moths lays a very large percentage of its eggs on the leaves of the trees; and studies have indicated that in their search for the apples, a large proportion of these worms become poisoned crawling over the sprayed leaves, or, through other causes, never succeed in finding the fruit.

It is quite different with the moths of the summer brood. They apparently prefer to lay their eggs directly upon the apples, and all the worm needs to do is to break out of the egg shell and start digging into the fruit. The chances of it being killed by spray are far less remote than is the case of the spring worm which hatches on the leaves. If weather conditions are favorable for the moths of the summer brood to lay large numbers of eggs, so that there may be an average of four or five eggs deposited on each apple, serious damage is likely to result to the crop, regardless of the

(*Concluded on page 45*)

The Orchard Home Department

By Mary Lee Adams

Too Many Things

UNLESS we are wealthy, there are two insuperable obstacles to our possessing very many things. These two are money and time. Naturally, we cannot afford to buy a great deal, but if a vast abundance of household possessions were given us outright, we could ill afford the precious time required to keep them in order.

It is difficult even for the rich to secure enough service to assure the smooth running of their large establishments. More and more, people of means in the cities are giving up their great mansions and moving into hotels because the problem of keeping up the big house proves too much for the mistress.

The orchard woman is fortunate in that she and her family usually occupy a house to themselves. No hotel or apartment, however well appointed, can compare with that in the priceless quality of a real home atmosphere.

But very often the wife and mother is the only person to do everything about that house. By the time she has cooked, cleaned up, tended the children, sewed a little, and disposed of the so-called odd jobs, there is scarcely a minute of precious time left for diversion, for reading, for friends, for healthy exercise or even for needed rest.

Little as we like to acknowledge it, there is no doubt that the small house, simply furnished, takes far less time to keep in order. To sweep too spacious floors, to polish much furniture, to dust a hundred knicknacks, to shake out many rugs, takes time and lots of energy.

If you are starting out housekeeping, you will do well to select a small house and to restrict the number of articles you put into it. A few good pieces look 100 per cent better than any number of cheap trifles. If we stop short of bareness, we shall find that beauty waits upon restraint. If you already have overloaded rooms, plan what you can eliminate without inconvenience.

Help the House Plant

HAVE you been discouraged this winter by the poor condition of your house plants? If they have survived up to this time, do not give them up in despair. There are two more months ahead of most of us before we may count on anything blooming out in the open.

As a first aid to drooping plants, examine the roots. Prolonged subjection to unfavorable conditions of soil result in root sickness. If the soil has been kept too wet you will readily detect this by the appearance of the roots. If not enough moisture has been given, all the tender little feeding roots will have perished.

Worms may be found. In this case it is likely that the soil is sour. You may sweeten it by giving to the soil (not the leaves) weekly applications of lime water in the proportion of a heaping tablespoonful to a pint of water. Allow this to settle after being well mixed.

Perhaps you have denied your plants the health giving location of a sunny window in a room that is not overheated. By all means try to secure this for them. Artificial heat is apt to be very drying. It absorbs the natural moisture of the plant, and then the leaf pores, which are the lungs of the growing plant, become filled with impalpable dust. So the poor thing stifles for lack of breath.

Sprinkle your house plants once or twice a day, and as a further aid for overcoming artificial dryness, set the pots in some tray or vessel in which may be kept an inch of constantly wet sand or moss. The pots standing upon this will absorb a very helpful amount of moisture, though it should not take the place of periodical watering.

It is the most charming alleviation of the indoor months that we may bring bits of our gardens to live with us through the cold weather. But we must take pains to inform ourselves what flowering or foliage plants are best fitted to thrive in the conditions we are able to offer them. Fortunately there is a fairly wide range suited to varying degrees of heat and light.

Sleep and Rest

MOST busy women who live in the country find that they can sleep without rocking. Some, however, find it hard to induce that mesmeric condition which we find so refreshing after the cares and toils of the day. A large part of the very real suffering occasioned by too brief periods of sleep is the wearing thought that unless we get the full amount of slumber we will fall constantly further and further below par.

This thought works up a nervousness, which is reflected in increased difficulty in securing the requisite amount of sleep. So one may go from bad to worse. Medical men are doing us a real service in suggesting that much less sleep is needed than commonly supposed.

What we need is rest, and if we compose our minds with the conviction that lying awake simply means that we ought to take a longer period of relaxation than if we slept soundly, we shall find it much easier to be tranquil under the trial of sleeplessness. In all probability, this state of mind will facilitate the composure necessary for sleep, and before long the periods of waking will become shorter and shorter.

Jealousy in Children

WHY BE surprised that little tots show jealousy when it's only hard training and a sense of decency that keeps most of us from openly showing the same unlovely trait? The unfettered candor of childhood knows no such restraint. Many mothers own that they are afraid to let anyone give one child something, unless the same or its equivalent can be provided for the others.

There may be excuse for this during the very earliest years, but it does not seem the right way to overcome an unamiable quality. No right-minded mother will let one child feel that it receives less love or care or consideration than another, but even quite small children can be influenced through their affections to take pleasure in the delight of a little brother or sister.

One of the sweetest scenes I've witnessed lately was when a small girl was presented with a gift in the presence of her six-year-old brother. Far from resenting that he had been left out, the little fellow, on seeing her delight, threw his arms around the neck of the donor and gave her a hearty hug of thanks for the joy brought to his adored "little 'ister." Learning to take pleasure in the pleasure of others is a grand cure for selfishness.

Gypsy Wife

I would not chase a roll of dust
From one room to another;
My father, Fire, will purify;
And so will Earth, my mother.

My sister, Rain, my brother, Wind,
They sweep my tent for me;
I do not shut my kinsfolk out,
And so they make me free.

No floors have I to break my back;
No windows to keep bright;
I've time to watch the clouds by day,
The solemn stars by night.

—*Florence Van Cleve.*

Baggage men in certain large cities have registered a complaint that their custom has been severely cut down by the light attire of the present-day woman. Where a trunk was formerly a necessity, a suit case that can be carried by hand has supplanted heavy luggage.

Our Two Great Washingtons

AMERICA is singularly fortunate in her two great Washingtons—George, and the city that bears his name. To the first we owe the second. In this month of February, during which his birthday occurs, we recall afresh our debt to the Father of his country.

This has been well drilled into us at school. We admire, we revere, George Washington. We acclaim him gladly, but do we feel for him spontaneous affection? The national idol has been presented to us too persistently as that stern creature, the soldier, or that cold figure, the statesman.

Few of us, I fancy, would feel any yearning for a chat with him. What could we say that would interest his loftiness? Most of us would be scared to death. The great man seems aloof, apart from human foibles and everyday concerns.

Even as You and I

For my part, it was a great relief to me when I read of his attending a dinner party and holding a lady's hand under the table until she was forced to remonstrate. Down toppled the idol from his frozen shrine, and up rose in kindlier likeness "a creature not too bright or good for human nature's daily food."

You may be shocked, but for me this silly little incident, which may never have happened, served as the key to his softer side and unlocked my juvenile heart to the man who had, up to that time, held my deep but purely impersonal regard.

He Saw with the Mind's Eye

The successful planning of a single house and grounds seems to most of us quite a feat. Washington had the talent for visualizing things in a big, broad, effective way. He possessed the ability to create mentally a large and exceedingly beautiful city.

No city of size can be carried very far in the short span of a decade. It can be visioned and outlined and the work set afoot. That is what George Washington did for Washington, D. C.

See Washington First

This month of February seems a fitting time to urge every one of you for whom a trip is possible, to visit our national capital. If you may choose the season, remember that April brings clouds of pink cherry blossoms to blush in the mirror of the lagoon that lies before the snow-white loveliness of the Lincoln Memorial.

Hundreds of visitors flock to the city to enjoy this enchanting spectacle. To see Washington is to be thrilled by its present beauty and tremendously impressed with its promise of a yet more magnificent future. But perhaps its past, that far, dim period of the city's beginnings, will stir you as deeply.

Think of our first President, as described by the Hutchins, riding up and down the "Powtomack" river, pushing his horse through thickets, exploring the wooded hills, seeking, with his keen eye, for beauty and fitness, the ideal site for the nation's capital.

Called Genius to His Aid

In October, 1790, he decided upon the present location. With him was associated Thomas Jefferson. All who have seen the private homes of these gentlemen—Mount Vernon so near the city, and Monticello not far away in Virginia—will feel that no happier combination could have been formed.

The childless Washington, like a true father, lavished love and visions of a glorious future upon his namechild, the infant city of Washington. Realizing, with characteristic modesty, that there existed his superiors for the actual carrying out of detailed plans, he sought the aid of that distinguished Frenchman, Pierre Charles L'Enfant, then residing in America.

To him is largely due the unique and artistic laying out of the city. Standing forests were "slashed into avenues and streets." Parks were provided for. Gradually the rough woods took on the semblance of civilization.

Government Enters In 1800

Not until 1800 was the government established at the present capital, but in the meantime its founder had shown splendid aptitude in selecting sites for public buildings. No location could be finer for that noble edifice, the Capitol, than the one Washington picked out on the "oak crowned eminence of Jenkin's hill," which L'Enfant, with Gallic enthusiasm, declared to be standing like a pedestal awaiting its monument.

Imagine the joy with which these two, riding together through the woods, happened upon the charming spot where the White House now stands. Washington immediately decided that this was the proper place for the President's residence. In 1792 the cornerstone was laid, and in 1799, the year of Washington's death, the central portion of the present structure was completed.

A Lofty Enterprise

A great game it must have been to peer into the future and plan, in the depths of the wildwood, a capital city befitting such a nation as the United States of today. When we think what a mere baby of a nation it then was, we marvel at the foresight of the man who, from the very beginning, advocated a stateliness and spaciousness which would be in keeping with our present importance.

What You May See

There is no end to the interesting places you really should see in Washington. One method of "doing the city" thoroughly is to get an official guide book or an official guide and set to work in good earnest. Some of us prefer to be less severely conscientious.

If you are that wisest of all collectors, a collector of "memory gems," loiter down the sunny mall past the towering Washington monument which, from afar, stands like a white, taper finger beckoning a welcome to the stranger.

Pass onto broad Seventeenth Street, with the President's Park on one side and on the other, gleaming against the blue sky, those strikingly handsome buildings, the Corcoran Art Gallery, American Red Cross, Continental Memorial Hall of the D. A. R. and, most perfect of all, the Pan American, than which few buildings in the world rank higher in the estimation of experts.

Cross over into Potomac Park and, when you have feasted your eyes upon the flawless symmetry of the Lincoln Memorial, your memory gems will be an unforgettable sequence of lovely pictures.

Further Afield

Mount Vernon may not be omitted without grave disrespect to Father George and serious loss to yourself. And who can leave without paying the tribute of a sigh at the tomb of the unknown soldier who lies, with thousands of our soldier dead, in the National Cemetery at Arlington, the old home of Gen. R. E. Lee, which was laid out by that same L'Enfant who designed the Capital.

At the close of day you may immerse yourself in the ethereal loveliness that hovers about the great bridge arched high over Rock Creek water. When the sunset haze mingles with the many softly glowing moons that light its span, the stream of water far below gleams darkly, while the stream of motors above flashes along the bridge like shooting stars. Lean your arms on the parapet and gaze into the twilight sky. It is the hour of dreams.

"San Jose Scale Saved My Orchard"

(*Continued from page 7*)

"He got so interested telling me what I could do with those trees that he hardly ate any dinner at all. He has stopped here several times since, but that was the only time I ever noticed a lack of appetite. He kept referring to his own trees at home, and I thought we had a pretty good joke on him when, in answer to my wife's question as to how large his orchard was, he said, 'Seven apple trees and three pear trees.' It didn't seem to bother him any even if we did laugh. He told me that if I used the same methods on my orchard that he had used on his few trees I would make a success of it.

"I am not in the habit of buying

George T. Groh in his apple orchard

lightning rods or sets of books from agents, but there was something in what he said that made me think I ought to give the orchard another chance. My Uncle Adam, whose place adjoins mine, had 450 trees and I had 550 good ones. We thought that probably one sprayer would handle them all, so the next day I went to Kansas City and bought a big triplex sprayer.

Good Results Despite Hail Storm

"We put on the sprays which were recommended by the college, and my orchard was surely looking fine, when in May, we had the worst hail storm that I ever saw in my life. It cut and bruised the apples, and was so bad that it even cut twigs right off the tree. Wathena was a blue place the day after the storm, and although we were hit hard, I did feel sorry for that poor easterner. That was his first year on the job, and we were just beginning to realize that what he had told us was the truth. Even at that, I believe that he felt worse for us than he did for himself.

"A buyer who looked over my apple crop just before the hail storm estimated that my apples would grade over 90 per cent number ones. After the storm things looked black for us for awhile, and we thought that to put on more sprays would be simply sending good money after bad, so we put the sprayer away for the season.

"When picking time came, I was surprised to find that I had 4200 bushels of sound fruit, and 2000 bushels of bulk, or cider stuff, and this, you must remember, was in an orchard that had never yielded over 750 bushels of apples before.

"Naturally, I was becoming interested in the possibilities of orchard spraying, and during the following winter I tried to get my trees into shape to make spraying easier. I mentioned the fact before that these trees were too high to spray conveniently. I used a tower on my sprayer, but even with that, I couldn't reach the top of some of those trees. The easterner knew something besides San Jose scale. Day after day he spent with me in the orchard explaining the principles of pruning, and after supper we would light up our pipes and discuss orcharding long past the time we should have been in bed. By this time, I was what polite people would call an orchard enthusiast and what others would call a 'nut' on the subject.

Pruning Methods

"This road which separates my north and south orchards is a direct road to St. Joe, Mo., and while at work pruning trees, I was the object of a good deal of ridicule from passersby who were on their way to the city. I heard such jokes as 'Why don't you prune them at the ground' so often that they became tiresome. I don't suppose that I ought to have let those remarks bother me, and nobody but my wife knows how much they really did. I stuck it out, however, until I had dropped the height of all these trees so that they could be properly sprayed.

"You see this old Jonathan tree here? When we got through pruning this, it looked like a 'before and after taking' picture reversed. It looked sicker after we got through with it than it did before we started. Yet the following fall, it yielded 11 barrels of number one Jonathans, and Jonathan apples meant money that year.

"My old orchard is made up mostly of Ben Davis, Gano and Jonathan trees. There isn't much difference between Bens and Ganos; they are both sure bearers, produce fruit of good size in Kansas, the apples keep well, and while nothing wonderful for eating, are mighty good cooking apples. The only drawback to them is that they are subject to Illinois blister canker. But by painting all pruning wounds, and by including fungicide in my summer sprays, even this hasn't bothered me much since I began spraying.

"I was anxious to put on all the sprays recommended by the college, and the next year I had an opportunity to do so. In the fall of that year I sold my crop for $3386.11, which meant $6.09 a tree, or $300.45 an acre. You must bear in mind that that was before the war, when a dollar would buy 100 cents' worth of goods.

"My Uncle Charlie owned these trees here at the end of my orchard, and as it was practically a part of my orchard, I wanted to spray them not only for his sake but for my own protection. Consequently, I told him that I would spray them for one-half the crop. When I settled with him, his return from the apples netted him $109.16 an acre for his share. That was more than the cider man would have paid him.

Experience Showed the Possibilities in Apple Growing

"My experience with this old orchard convinced me of the possibilities of apple growing in Doniphan county. Yet I realized that these old trees were now in their prime and that if I intended to stay in the game I would have to plant a new orchard to take the place of this one when it was gone. No one knows just how long an orchard will live here if it is given decent care. I felt that my old trees had a good many years of service left in them, but I didn't want to take too much of a chance.

"There goes my last match. I seem to be smoking nothing but matches this morning.

"Thanks, that will save me a trip to the house. Now that my pipe is going good again, let's go over and look at the new orchard, planted after my own ideas.

"I selected these 15 acres here on the bank of the river, and although Ben Davis and Ganos have made a lot of money for Kansas fruit grow-

(*Concluded on page 45*)

When It Rains Look Out for Scab

(*Continued from page 9*)

cates that the schedule was faulty for so severe a season. In reality, one or more applications might have been put on at some critical point. In 1922, the infection came late, as the table shows that omitting the calyx spray was very serious, while omitting the delayed dormant and pre-blossom applications did not occasion much loss. Scab was a more or less negligible factor in 1920 and 1921, but outside of these years it will be noticed that the first sprays of the season were generally necessary to prevent primary infection.

Nature is the Dictator

The point to emphasize is that so many fungous diseases attack under a barrage of rain. But rain comes when it takes a notion. Long distance weather forecasts are good but not always accurate for each locality. With small orchards some growers do fairly well by getting out right after a rain and covering up before the spores sprout and enter the tissue of the fruit or foliage. However, only certain methods may be employed on wet trees or with sufficient speed.

One might better plan to meet every rainy period with a coverage of protective fungicide. The length of time that one application should be considered safe varies with the time of year and climatic conditions.

When the fruit and foliage are making a big increase in size every two or three days, it is nature and not man who dictates they should be protected frequently.

Going Into Reverse

"I wasn't doing 40 miles an hour," protested the motorist. "Nor 30, nor even 20."

"Hold on," interrupted the magistrate, "or you'll be backing into something."—*Tit-Bits.*

Louder

Distressed Prof.—Why don't you answer me?

Frosh—I did shake my head.

D. P.—Well, do you expect me to hear it rattle way up here?—*Burr.*

Pillows for the Farm Home

ALL FASHION experts agree that a few of the "right" accessories can transform the plainest and most uninteresting of *dresses* into attractive and interesting *costumes*. The same principle applies to the house—it is the accessories that make the difference between just plain *house* and an inviting *home*.

Picture in your minds a living room in which only the necessary furniture is placed, such as tables, chairs, desks, rugs, and possibly a piano. Then, complete the picture by hanging glass curtains and drapes of suitable color and material to harmonize with the house and furnishings, placing a few well-chosen pictures on the walls, arranging a crush scarf with a piece of pottery, lamp or basket of flowers on the table, placing a pair of book-ends with two or three attractively bound books on a low table near a reading chair, placing a pair of wrought-iron, brass or mahogany candlesticks with tall candles on the mantel with possibly other pairs in suitable places throughout the room, hanging a gayly painted wall shelf with a piece of pottery and a few books on one wall space near a chair and adding a woodbasket to match for the hearth, then finishing off with a set of fireplace tools, a wrought-iron fernery, a comfy-looking footstool, parchment-shaded lamps, and pillows of all sorts and descriptions.

Accessories Important

From this experiment you will readily see that it is the small, interesting accessories that "make" a room or a home, rather than pieces of furniture, no matter how good or how well arranged the furniture may be. These accessories may be few and simple for the simple home, or they may be numerous and more elaborate for the more pretentious home. A few pictures, one pair of candlesticks, a footstool, suitable curtains, a few books, and the crush table scarf with basket or pottery, together with a profusion of interesting and comfy looking pillows could easily transform an otherwise plain and ugly room without the addition of another thing. Many of these accessories could be made at home, and none of them need cost very much. The important thing is to understand their need and use, and to acquire the desire to possess certain suitable ones.

Pillows alone can so change a plain, bare room that it will appear pretty and inviting without adding anything else. And it is of pillows that we wish to speak in the article for this month.

Simple Pillows Popular

Heretofore, when we thought of pillows we pictured in our minds rich, expensive creations of velvets, satins, and brocades, all betasseled, shirred and decked in hand-made flowers. Such is not the type popular at the present time. The vogue in pillows is for the clever, simple type, made of inexpensive materials, though, of course, certain city living rooms still show the other kind. This new style certainly is a boon to the farm housewife, because the pillows are so decidedly suitable for use on the farm, where the fussy, silken ones never were and never could be either practical or suitable.

Floor Pillows Described

The stores displayed a clever pillow of oilcloth recently. It was a deep, drum-shaped pillow made to rest on the floor and serve as a footstool. It was made of that new decorative oilcloth that is soft and pliable and has a "grained" rather than a "slick" finish. This oilcloth comes in dozens of interesting colors, so that the housewife can easily find colors which will harmonize with the other things in her rooms. The sample pillow on display was lettuce green oilcloth with painted decorations on the sides in orange and darker greens with a touch of black. Then there was another floor pillow of the same type made up in Chinese red (an interesting rosy red shade) with decorations in black. The pillows might also be orange, blue, brown or gray, with suitable touches of contrasting color, the color scheme to depend on the colors used in the room. Be sure that your pillows are gay colored, however, as therein lies their chief value—the ability to add a touch of cheerful color in a delightful manner.

The big pillows on display were about 14 inches deep, and 16 to 18 inches in diameter. The top and bottom pieces were circular while the sides consisted of a straight band with the ends sewed to form a circle the same size as the top and bottom pieces. The top and side pieces may be sewed together by machine with the seam to the wrong side, the bottom may be sewed on part way in the same manner, then the inner pillow may be inserted and the final joining done by hand. Or, the pillow may be put together with the seams to the outside and the seams then trimmed and bound in contrasting-colored bias tape. The pillow should be placed inside before the last seam is started.

May Be Decorated

The decorations should be completed before the pillow is put together, as only in this way can you have a flat surface on which to work. A stencil in conventional design by using paints may be used to good effect. Oil paints would be best, especially if given a coat of shellac or clear lacquer to prevent their wearing off. Enamels would be too brittle and would crack if used on flexible material. Applique designs done in contrasting colored oilcloth and either carefully glued or blanket-stitched on would also form effective trimmings for this and other types of oilcloth pillows.

When you get material for the large oilcloth floor pillow, get enough extra for a small round, oblong or square pillow of the same color for the couch or davenport. By doing this, you will insure a certain amount of harmony from the start. A design similar to the one used on the large pillow, but of course much smaller and in keeping with the size of the couch pillow, could then be painted or appliqued on this pillow. For a circular or square pillow of this type, cut top and bottom exactly alike and then stitch them together with seams to the outside, trim the seams and bind in contrasting colored bias tape or decorative oilcloth. Round pillows are pretty with no decoration other than contrasting binding.

Cretonne Is Pretty

Cretonne pillows of various shapes have always been popular and still find favor with decorating experts. Cretonne pillows have the best appearance when somewhat soft and "squashy" and not stuffed too firmly. The favorite shape for a cretonne pil-

low is made with two small circles for the top and bottom and a folded strip shirred onto these circles to form a folded and slightly rippled outer edge to the pillow. The center circles may be about six or seven inches across, depending on the size of the finished pillow. The folded strip would then be, when double, an inch or so less than the diameter of the center circles. This would insure a nice proportion. The raw edges of the strip should be turned in with an iron and a strong gathering thread run through each turned back edge. These threads may then be pulled up to the desired size around the top circle, the side strip may be pinned in place with pins spaced about one inch apart, then they may be basted together and finally stitched on the machine. Next, the pillow should be inserted. Then the under circle may be put in place in the same way as the first circle, except that it must be sewed by hand. The inner pillow should be smaller than the finished pillow by about one and one-half inches.

The Patchwork Pillow

The very newest thing in pillows, however, is the patchwork pillow! These pillows are made out of two or three materials pieced together in old-fashioned patchwork-quilt designs, such as the pine tree, Star of the East, flower basket, etc. Ginghams, percales and English prints with their tiny, conventional patterns are exactly suited to this type of pillow. The patchwork may take the pattern of a conventional flower with stem and leaves, or it may take the form of one large flower, such as the aster pattern with its alternate pointed petals of dark and light material and covered button center, the whole mounted on a sage green or other suitably colored square pillow background. What could be more inviting than an old-fashioned couch heaped with delightfully quaint patchwork pillows?

Felt offers unlimited possibilities for pillow making. It can now be purchased by the square inch so that no more material need be bought than is absolutely necessary. It comes in lovely colors, and its wearing quality is unsurpassed, though the moths will eat it if given the opportunity. The very cleverest pillow of this type that I have seen was made as a Christmas gift. It was of black felt made in a round, flat pillow with small scallops all around the edge. The top and bottom scalloped circles were cut from a pattern, on a circle about 18 inches in diameter. Then a parrot design in gay colored felts was worked out and glued carefully in place on the top circle. One of the well known pattern companies offers a pattern for a similar pillow. The parrot in gorgeous colors rests on a flowered, leafed and gracefully shaped twig. The pieces of felt are pressed in place after being glued and placed in position on the pillow, then allowed to dry in the press. Then the two circular pieces are matched as to scallops and basted together half way around, the flat inner pillow is inserted, the basting completed, then the stitching made permanent on the machine. A suitable cord may or may not be used to cover the stitching line, as desired. Any other suitable moonlight scene, landscape or Japanese-bird-and-water type of design may be used with equally good effect for this pillow.

These are just a few suggestions for inexpensive yet interesting and unusual pillows. They have another quality to recommend them in that they are all made of materials that can be really used and enjoyed on the farm without fear of soiling or tearing by rough, workmen's clothes.

Pillows Soften Outlines

The pillows should have a seemingly careless arrangement—they should be piled in the couch, tucked in a comfy chair, placed on the floor (if in large and suitable shape) in front of the hearth, couch or reading chair, or they should be placed on the floor in corners or near table or desk legs to soften and cover up ugly or uninteresting angles.

Every homemaker should get inspired on the subject of interesting pillows, and these in turn will inspire her to make other charming, yet inexpensive accessories for the home.

Recipes for Apple Dishes

MONTH in and month out, year in and year out, the fruit that retains its universal popularity with all classes and all ages of people is the good old standby—the apple. We have given recipes for apple dishes in this department on several occasions in the past, but we are convinced that additional ones will always be welcomed by our readers, especially so when they find that the recipes given are simple, yet new and interesting.

Steamed Apple Cobbler

Select 6 small or 4 large well-flavored apples. Pare, core and slice apples. Prepare biscuit dough, reserve enough to form a cover for cobbler, then roll remaining portion thin and line the sides of a deep pan with it, letting about one inch of dough hang over the edge of pan. Place half of the sliced apples in the pan, sprinkle with ½ c. sugar, dust with cinnamon and nutmeg, and dot with butter. Roll out rest of dough and place a layer of dough over the apples. Put the remaining half of sliced apples in next, sprinkle with ½ c. sugar and season with cinnamon, nutmeg and butter as before. Fold the lower crust over the top so as to leave an open space in the center. Pour in 1 c. boiling water. Bake in moderate oven until brown and apples are tender. Serve with cream.

Baked Apple Salad

Peel and core, but leaving whole, firm, well-flavored apples, allowing one apple for each service. Bake in moderate oven. When cold, fill the center cavity with chopped nuts, olives and pimentos mixed with salad dressing. Pour salad dressing over the apples and sprinkle with nut meats. Serve on individual lettuce leaves. The apples may be baked with the skins on to give additional color, or, red apples may be baked with the skins on, then the skins may be carefully removed and scraped, the red apple pulp thus secured being applied evenly to the fruit to give the apples color. Do not overcook the apples.

Sausage with Apples

Fry country sausages which have been formed into pats until thoroughly done. Remove the meat from pan. While meat is frying, the apples should be prepared. They should be peeled, cored and cut into slices about half an inch thick. Dip apple rings in sausage fat and fry slowly until done. Place these rings around the sausages. Garnish with parsley or rings of red bell pepper and serve very hot.

King Apples

Pare and cut in round, thin slices selected apples, taking care to remove all traces of core. Let stand for a short time in sweet cider, lemon juice and sugar in any desired proportions. Drain, dust with flour, then fry in very hot butter on both sides. Sprinkle with powdered sugar and cinnamon, and serve hot.

Apple Delight

Pare and core sound, tart apples. Make a syrup of 2 c. sugar and 1 c. water. Let boil 5 minutes. Put apples in syrup and turn them often so that they will keep their shape. When tender, lift out carefully and drain. Sprinkle generously with sugar and glaze in the oven. Arrange on plate, fill centers with red jelly and serve with whipped, sweetened cream, used as a garnish around the apples.

Apple Snow

Boil 6 pared and cored apples until tender, press through a sieve, return pulp to juice, add 1 c. sugar and boil to a thick marmalade, cooking very slowly towards the last and stirring to prevent scorching. Cool. Beat whites of 4 eggs stiff and dry. Add 2 T. sugar, beating constantly, then add pulp gradually. Beat until feathery. Add juice of one-half lemon. Heap on a dish, cover with grated cocoanut, garnish with fruit, and serve in stemmed glasses.

Upside-Down Cake

Select firm, tart apples, peel and cut in halves lengthwise, removing all traces of core. Arrange halves in buttered baking pan, cut side down. Sprinkle with sugar (brown sugar preferably), cinnamon and butter. Make a cake batter of 1 c. flour, 1 egg, ½ c. sugar, 2 T. butter, ½ c. milk, and 1 t. baking powder, using the usual method for butter cakes. Pour the mixture over the apples. Bake in moderate oven for 45 minutes. When apples are tender, remove from oven, turn cake over, and serve either warm or cold with whipped cream or fruit cornstarch sauce (thin).

Table of Abbreviations.

1 t. equals 1 teaspoonful.
1 T. equals 1 tablespoonful, 3 t.
1 c. equals 1 cupful (standard).
1 pt. equals 1 pint (2 standard c.).

All Measures Level.

Pipe Smoker Hunts Two Years For Right Tobacco

Finally discovers it within reach of everyone.

The good old maxim, "If at first you don't succeed, try, try again," evidently applies to tobacco as well as anything else.

Many a man has quit trying after a few different brands have failed to give him pipe-smoking satisfaction. Here's the story of a man who persevered until he found the kind of pipe tobacco he spent two years searching for:

Dallas, Texas,
March 22, 1927

Larus & Bro. Co.,
Richmond, Va.

Gentlemen:

The worst thing in the world to try to find is a good pipe tobacco that is well within the reach of everybody, and at the same time does not taste like it had just come out of the cabbage patch.

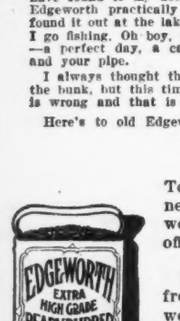
I have been smoking a pipe for two years and have just this month started to smoke a real smoke, Edgeworth. If at first you don't succeed, try, try again. Believe me, I tried for two years, but finally success is more than mine.

I have just been looking around, and have found to my delight that I can get Edgeworth practically anywhere. I even found it out at the lake near Dallas where I go fishing. Oh boy, what a combination—a perfect day, a can of good tobacco, and your pipe.

I always thought these ad letters were the bunk, but this time I know somebody is wrong and that is me.

Here's to old Edgeworth,

Edmund Condon.



To those who have never tried Edgeworth we make this offer:

Let us send you free samples of Edgeworth so that you may put it to the pipe test. If you like the samples, you'll like Edgeworth wherever and whenever you buy it, for it never changes in quality.

Write your name and address to Larus & Brother Company, 13 S. 21st Street, Richmond, Va.

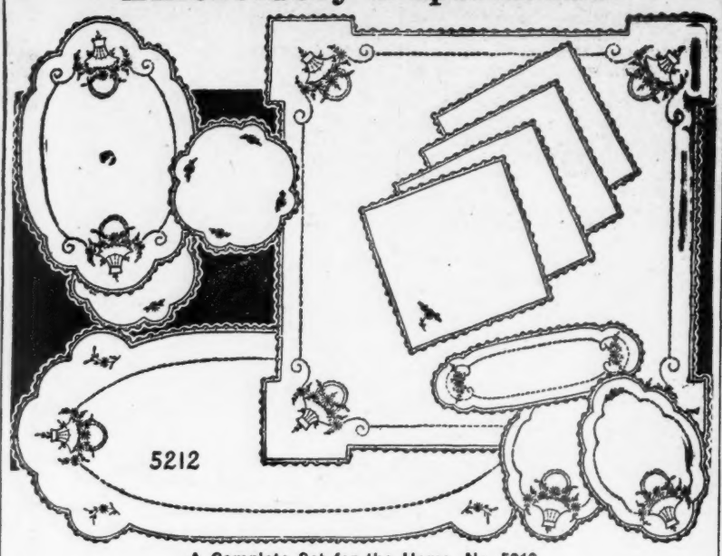
We'll be grateful for the name and address of your tobacco dealer, too, if you care to add them.

Edgeworth is sold in various sizes to suit the needs and means of all purchasers. Both Edgeworth Plug Slice and Edgeworth Ready-Rubbed are packed in small, pocket-size packages, in handsome humidors holding a pound, and also in several handy in-between sizes.

To Retail Tobacco Merchants: If your jobber cannot supply you with Edgeworth, Larus & Brother Company will gladly send you prepaid by parcel post a one- or two-dozen carton of any size of Edgeworth Plug Slice or Edgeworth Ready-Rubbed for the same price you would pay the jobber.

[*On your radio—tune in on WRVA, Richmond, Va.—the Edgeworth station. Wave length 254.1 meters. Frequency 1180 kilocycles.*]

Embroidery Department



A Complete Set for the Home, No. 5212.

We have just completed a combination of scarf, buffet and vanity set, and a five piece luncheon set consisting of one 36 by 36 inch lunch cloth and four napkins, all stamped on fine quality Indian Head, for the very low price of $1.50 complete. This is the lowest figure at which such a set has ever been offered. The design is most attractive. A detailed working chart showing the exact color scheme is furnished with each piece.

For 25 cents additional, we will send you our book, "The Art of Embroidery." This consists of 10 complete lessons with 70 illustrations showing all the principal stitches in embroidery.

Embroidery Department, American Fruit Grower Magazine,
7417 Luella Avenue, Chicago, Ill.

What We Are Judged By

HOME TRAINING is reflected in the manners of children more accurately than in anything else they learn from home environment. This does not mean that manners are most important of all, but it does imply that they lie almost entirely within the power of parents to make or mar.

We may see one child of excellent parents turn out badly, while another is all that the fondest mother's heart could wish. But both the good and the bad child will have the manners they have been taught at home.

Perhaps it would be better to say they will have the manners they have been taught and have observed at home. Telling a child that he should do one thing and then doing another yourself, is worse than useless. It fails to establish him in proper procedure and leaves him in a critical attitude toward you.

Worthy parents are more often, and possibly more justly, blamed for having brought up rude and ill-mannered young people, than if some of their flock turned out lacking in far more important qualities, such as sobriety and honesty.

So it becomes really a matter of self-respect to see to it that the children are early led, both by precept and example, to show good breeding. Absolute rudeness is not often overlooked, but the small observances that like straws show outsiders which way the wind blows at home, are often neglected.

Nowhere does this appear more plainly than in what we call "table manners." For those who, like so many orchard women, have little or no hired help, discipline at meals becomes a problem. Even with people of refinement, there is the temptation to be slack in observance where the meal is cooked and served by the mother.

But no "frills" whatever are necessary to accomplish the desired result. Once the solid foundation of lasting good breeding is established, the little usages that vary with each decade (such as which of many knives or spoons to use first) may be learned at a single meal.

Scrupulous cleanliness, orderliness and consideration for others, must, however, be literally a part of the children's daily bread, so that it becomes as natural to them as breathing. Eating with the knife may occur only in the most ignorant or most careless of families, but in not a few, hungry children are allowed to snatch, to reach over others, to stuff the mouth or talk when it is full, to drink water audibly.

Though these and many such little habits seem trifling, they become unbelievably hard to break. They will tell against the boys and girls in later life, especially when they go away from home. Strangers, noting their deficiencies in these respects, decide that they are either no credit to their homes or that the homes themselves are not very creditable. They may conclude not to welcome them into their own social circle.

Apple Recipe Book

APPLE GROWERS and distributors throughout the country are most appreciative of the efforts of the Union Pacific System to add to the popularity of the already popular apple. The railroad company compiled and had printed for general distribution thousands of copies of a most attractive and useful booklet of apple recipes. The booklet, containing 150 tested recipes for new and appetizing apple dishes, is the best thing of its kind that the writer has seen. Fruit growers generally are profiting by the free advertising, and the fruit growers' wives might as well profit through the use of the booklet. Readers of the AMERICAN FRUIT GROWER MAGAZINE may obtain copies free of charge by addressing the Agricultural Department, Union Pacific System, Omaha, Neb. Or, if the reader lives near a large city in which there is a branch office of the Union Pacific System, he or she may obtain a copy direct from the local office.

Couldn't See It

Father—The man who marries my daughter will get a prize.

Suitor—May I see it, please?—*Exchange.*

To clean a rubber apron that is badly soiled, rub with a damp cloth dipped in a little baking soda.

Bee Keeping for Fruit Growers

By H. F. Wilson

Making the Start With Bees

WHEN one gets the bee fever, there is practically only one successful treatment, and that is a good dose of bees. Every person is not qualified to keep bees, because only those who have a love for nature and can find something interesting in the life and development of the honeybee, will find beekeeping more than a passing fancy. One may become inoculated with the bee fever from several sources, such as catching a stray swarm, a visit to a bee yard, or reading about the bees' industrious habits and possible financial returns.

As a rule, the beginning is made with a stray swarm, placed in an old box of some kind, and at first it may appear like a "white elephant," for the owner finds his bees in a box where he cannot observe them, nor is he able to study the bees, except as they come and go from the entrance, and then there seems no possible way in which to secure a bit of that honey which the owner is sure the bees are storing away somewhere within their home.

So, now the question is, "How shall I go about getting my bees into a regular hive, with movable frames, so that I may examine the bees at frequent intervals and provide storage space for securing the honey which the bees bring in from the flowers?"

Secure Necessary Equipment

With this problem at hand, it will be well to visit one or more neighboring beekeepers before taking the next step. The bees will have to be transferred from the old box hive to the new hive, and for successful beekeeping, extra hive bodies and comb honey supers will be necessary in order to secure what the beekeeper speaks of as his surplus crop. If there are no beekeepers in your neighborhood, then you should immediately secure a catalog from one of the bee supply dealers and order a complete hive with extra supers, a smoker, bee veil and a hive tool. The hive tool is used to pry loose the cover and the frames, which will normally be found glued tight with masses of propolis, a gluey substance from the buds of trees, mainly willows and poplars.

Transfer Bees to New Hive

After the new equipment has been received, the next step will be to transfer the bees from the old box hive to the new hive, without loss of queen, bees or honey, and with the least difficulty. The new hive should be of the standard 10-frame make, the inside dimensions of which will be about 14 by 18 inches. First, prepare a board to rest on top of the old hive, and if the top of the box hive is less than the size of the new hive, the cover boards should be 16 inches wide by 20 inches long. Cut a hole in this board so that it will rest on the edge of the box hive, leaving an opening as large as the inside dimensions. On the other hand, if the box hive is larger at the top than the new hive, the board must be made large enough to cover the entire top. And the hole in this board should be made to fit the inside dimensions of the new hive.

Remove the cover from the old hive and place the new hive, without the bottom board, on top of the board. There should then be a clear space between the top of the old hive and the bottom of the new hive, so that the bees can work up from the lower hive to the upper one, and start drawing out the comb foundation in the frames of the new hive. If there is any nectar coming in from the flowers, the bees will soon become crowded in the lower hive, and will start to work in the upper hive.

When the comb foundation is drawn out, the queen will find her way upward, and begin to lay in the cells of the new combs.

As soon as the new comb is drawn out, the frames should be examined every four or five days until eggs or young brood are found. As soon as the eggs or brood are discovered, the queen excluder should be placed between the two hives to keep the queen from going down again into the old hive. Five days after the queen has been placed between the two hives, again examine the combs above the excluder, and if eggs are found, one may be sure that the queen is now in the new home.

Leave the hive and the excluder as they are for 25 days more, adding more hive bodies or supers on top of the new hive, as needed, to care for the nectar which the bees may be bringing in from the field. At the end of that period, all of the bees will have hatched out of the cells in the lower hive, and the hive may be moved to one side, lowering the new hive on the old stand.

After the two hives have been separated, place the old one beside the new one, but facing in the opposite direction. Then, in four or five days, most of the bees will have left the old hive and gone into the new one in its place. The old hive may then be broken apart and the honey and wax removed to the house and disposed of as seems desirable.

Increasing the Colonies

With this start, you will then be ready to increase the number of your colonies by dividing the old one, or securing new colonies from some other beekeeper. If you are not fortunate enough to find a stray swarm, then it will be necessary to either buy a full colony or else make your start with package bees or nuclei. A package of bees consists of from one to three or more pounds, and can be secured from a southern breeder. The shipping package is a basket made of screen, enclosed with wooden cleats for protection.

The bees are placed in this package without combs and with only a sufficient amount of food to carry them over a period of a week to 10 days. Each package contains from 5000 to 15,000 bees and one queen. Upon their arrival, the bees are placed in a hive and given sufficient food in the way of honey stores or sugar syrup to keep the colony going until nectar is available in the field.

A nuclei consists of one, two, three or more frames of brood, honey and pollen, each containing a queen, and are about equal in value to package bees of the same unit in pounds. When the nuclei arrive, the frames are lifted out and placed in a new hive, with drawn combs, or full sheets of foundation to fill the hive.

Package bees and nuclei shipped to the northern states about the first of May will build up quickly, and, if given good care, are able to secure a possible surplus of honey during the nectar flow in June and July.

"Did you ever catch your husband flirting?"

"Only once."

"What did you do to him?"

"Married him."—*Tit-Bits.*

Engineering for the Fruit Grower

By E. W. Lehmann

Carburetor Troubles

THE CARBURETOR might well be called the "heart of the motor," and no doubt there are many automobiles and tractors that die from "heart disease." To diagnose the carburetor troubles, there are a number of symptoms that should be kept in mind. One must always be on the alert to detect whether the trouble is due to poor adjustment or to a defective carburetor. This discussion will be devoted primarily to troubles in tractor operation. The most common results of carburetor troubles are: misfiring, backfiring in the carburetor, exploding in the exhaust, loss of power, black smoke in the exhaust and irregular speed. In other words, many of the motor's ailments may be due to the carburetor. In inspecting the carburetor, the first thing is to see that the fuel is flowing freely to it. This is best done by disconnecting the feed pipe at the carburetor. If the fuel trickles slowly, it is a sure sign that the line is clogged with dirt, scale, rust or lint. A special strainer is provided at the bottom of the fuel tank on most tractors; this should be cleaned and drained at regular intervals. Water may collect in the lower part of this strainer, as well as in the lower part of the carburetor, after a considerable run, so drain them occasionally. Examine the shut-off valve in the fuel line; it may be partially closed. If it is found that there is a good supply of fuel reaching the carburetor, it might be found that the passages in the carburetor itself are partially stopped with foreign particles. In other words, don't condemn the mechanical construction until all other sources of troubles are eliminated.

Misfiring may be due to a partially clogged fuel line, to a lean mixture, fuel pump needing repacking, fuel tank nearly empty, or water in the gasoline. If the trouble is in the carburetor and it is a lean mixture, adjust the needle valve for a richer mixture. Exploding in the carburetor indicates that there is an excess amount of air, which may be due to either too lean a mixture or air leaking into the manifold. The needle valve adjustment will usually correct the trouble, but tests should be made for air leaks.

Exploding in the exhaust is usually due to too rich a mixture; the rich mixture does not burn in the cylinder so is forced out into the exhaust, where it is mixed with additional air and fired by the hot particles in the exhaust pipe. Black smoke issuing from the exhaust is another result of too rich a mixture. Careful adjustment of the needle valve is the remedy. The proper way to adjust the needle valve is to screw it in until the motor pops back into the carburetor, indicating a lean mixture, then open the valve until the motor will carry the load on the least fuel. Make adjustment while motor is hot. If the tractor is operated at night, the flame from the exhaust pipe will indicate the kind of mixture that is being used. A red flame indicates a rich mixture, a yellow flame a lean mixture, and a blue flame indicates the correct mixture for complete combustion.

The proper level of fuel in the carburetor may be affected by the carburetor float. If a cork float is used and is giving trouble, dry it out and apply a coat of shellac. A leak in the metal float can be remedied by removing all fuel and then soldering.

Irregular speed of motor may be due to irregular fuel supply, which may be the result of the pump needing packing, the pipe line being partially clogged or the fuel low in the tank. All of these troubles mean a loss of power and inefficient motor operation. Carburetor troubles mean motor troubles, for too rich a mixture will cause carbon deposit and over-heating. Careful adjustment of the carburetor and a fuel supply that is clean, free from water and sediment are essential to successful tractor operation.

Tractor Development

AT THE recent meeting in Chicago of the power machinery division of the American Society of Agricultural Engineers, there was considerable discussion relative to tendencies in tractor design. The engineer in charge of tests at the University of Nebraska, in reporting the official tests made this year, indicated a range in size of tractors tested from the small garden tractor type capable of exerting a pull of 140 pounds to the big crawler type of tractor that exerted a pull of 20,000 pounds. This range in size indicates a wide range of power application. From the data submitted, it is evident that there has been a marked advance in tractor development during the last 10 years. There are fewer makes and better tractors being built than 10 years ago.

The tractors of today are being built lighter than a few years ago; there is less weight for each horsepower available. The machines are also more efficient than formerly; they require less fuel for each unit of energy developed. They are better lubricated than formerly. There is no question but what these new tractors are made of a higher grade of material than the tractors of a few years ago, and there is more refinement in design throughout.

When attempting to prophesy as to the type of motor our tractors of the future are to be equipped with, many engineers are liable to be biased by the practice they are now following. The kind of fuel used in the future may be the determining factor. Will these motors of the future be of the two cylinder type, slow speed to burn the lower grade fuel oils, or are they to be of the four cylinder type and burn only the lighter fuels? It is difficult to guess what the demands of the future will be along these lines. Much of our fuel of the future may be from waste products of the farm. Only time will tell.

In considering the requirements of a tractor we should keep before us the idea that the tractor will always be a heavy duty machine. Lightness and speed will not be as important in the tractor field as in the automobile and the airplane field.

Our demands for a tractor will always be for a slow speed machine, a heavy duty machine, and a machine that is economical to operate—in other words, one that will utilize fuel efficiently. This is quite the opposite of our demands in the automobile field, where a lot of excess power is wanted. The economical use of fuel is not so important; if it were, more motorcycles and more of the extremely light cars such as are found in Europe would be used. In the automobile field the public is demanding comfort, beauty and speed, and it is getting what it demands. The farmer will also get what he demands in the tractor field. If you want a tractor that has an easier riding seat, you can get it. Continued economy in the use of fuel will be demanded.

Carbon in a Motor Reduces Power

AN ACCUMULATION of carbon is found in most motors; to neglect it means a loss of power and inefficient operation. Carbon in the combustion chamber is no doubt the most common cause of loss of power in gas engines. There are two methods employed to remove the carbon from the cylinder. One method consists in burning the carbon out by means of oxygen, and the other method consists in removing the cylinder head and scraping the carbon out. The latter method is used when the valves are to be ground. When the valves are not

to be ground, the use of oxygen is an easy and a quick way. Ordinarily, this method would not be used on a farm.

By proper care in operating a motor, much of the carbon accumulation may be avoided. Having the carburetor adjusted for a rich mixture is a common cause of carbon forming. Proper adjustment not only results in better operation and freedom from carbon, but also economy in operation. Use only a high quality oil; it not only lubricates best, but there is less residue or carbon.

Another common cause of carbon is too much oil in the crank case. Every tractor or automobile motor has some means provided for indicating the proper height of oil; to have the oil above this level will usually result in more rapid accumulation of carbon.

The mechanical condition of a motor or the way it is operated sometimes is the cause of carbon forming rapidly. Badly worn piston rings allow too much oil to work into the combustion space, causing carbon to form. Allowing an engine to idle for long periods is conducive to the formation of carbon. Carbon does not form nearly as rapidly in a hot engine as in one which is running too cool, and it is not so likely to accumulate in one working under normal or full load as in one which is doing light work.

Carbon deposits reduce the power in three ways. By filling part of the combustion chamber space, they prevent a full charge from being drawn in. Carbon causes pre-ignition by reaching a sufficiently high temperature to ignite the incoming mixture too soon, which is evidenced by the well-known carbon knock. It prevents the free transmission of excess heat through the walls of the combustion chamber into the cooling water and thus causes overheating.

The Hydraulic Ram

IN MANY SECTIONS of the country where free flowing springs abound, many farmers can have an abundant supply of fresh water at a little expense by the use of a hydraulic ram. Always select your ram for the particular conditions that exist. A hydraulic ram will operate if the water delivered to it has a fall of at least three feet and flows at a rate of at least two to six gallons per minute.

In purchasing a hydraulic ram, always advise the manufacturer as to flow at the spring, the free fall below the spring, and the amount of lift from the proposed position of the ram to the storage tank.

A simple and fairly accurate rule to use in calculating the amount of water a ram will deliver to a given height, is to multiply the number of gallons per minute flow to the ram by the vertical fall to the ram in feet and divide the product by the vertical lift to the storage tank in feet and reduce the answer by one-third; the result would be the amount delivered to the tank. As an example, assume a flow of six gallons from the spring to the ram; the ram is located four feet below the spring and the storage tank is 24 feet above the ram or 20 feet above the spring. Six times four, divided by 24, equals one. Reducing this by one-third, we have two-thirds of a gallon delivered a minute, or 40 gallons an hour. Since a ram will run uninterrupted 24 hours a day, the amount delivered a day would be 960 gallons, which, with reasonable storage, would be an ample supply.

Many farmers have allowed the water from springs to run to waste that could have been delivered by a ram, and at the same time a more expensive system has been installed. It will pay to investigate the possibilities of a ram if you have a good spring on the farm.

"San Jose Scale Saved My Orchard"

(*Continued from page* 39)

ers, I decided not to plant any. This new orchard is made up of Delicious, Stayman Winesaps and old-fashioned Winesaps. I set these out in blocks of four rows each of one variety so as to get a good distribution of pollen throughout my orchard. I used the best trees I could get a d bought one-year-old whips, so that I could shape the trees as I wish. When I put them out, I headed each one of them 30 inches from the ground. You can judge for yourself as to whether or not I have done a good job in keeping them shaped since. Some might think I had, and others might think I hadn't.

Good Methods Bring Crop on Seven-Year-Old Trees

"During the first few years after this orchard was planted, I raised corn in between the rows, gradually narrowing down the space devoted to corn each year so that the trees would have at all times plenty of sun and air. I tried strawberries in part of the orchard and they did very well, but potatoes were a nuisance because they served as harboring places for the buffalo leaf hopper, which scars trees and checks their growth.

"I got my first apples from this orchard when it was seven years old. As a usual thing, an orchard has to be about 12 years old before it gets to bearing paying crops. However, when these Delicious trees were nine years old, I sold the crop from them for an average of $14 a tree, which you'll admit is pretty good.

"No, this is not unusual for this vicinity, for Mike Bauer sold his crop of Winter Banana apples from 70 trees for $936 when his trees were only 11 years old.

"Last year, which was the thirteenth year for this orchard, I harvested 4244 bushels of number one apples, and this, of course, does not include my ciders and culls. My old-fashioned Winesaps and Delicious have been my best paying varieties in the new orchard. If I had made the statement 15 years ago that the orchard would still be living, everyone would have thought that I was crazy. But, as I said before, we don't know how long an orchard will last with good care. That old orchard is still going good, and last year it yielded 8478 bushels.

"I think that people like to know where the apples that they eat are grown, so I stamp on the head of each barrel 'Kansas Apples, Grown and Packed by George T. Groh, Wathena, Kans.' I also stamp on the minimum size of the apples.

"I used to raise considerable alfalfa and corn, but now with these two orchards on my hands, I think that I can honestly call myself an orchardist. A drive through the county will show that most of the scoffers now use sprayers.

"Now, after tramping around both orchards, you must have worked up an appetite. Let's go in and get a bite to eat. After dinner I want to show you a few pictures of the orchards and some of the floats which were in the parade at the apple blossom festival last spring. You had better come in because I think I saw Albert drifting off towards the watermelon patch just as we started out. You like watermelon, don't you?"

Spreaders and Codling Moth Control

(*Continued from page* 37)

spraying. The better the spraying, the less the damage; but we can understand, as a result of the experiments above mentioned, that arsenate of lead is not capable of giving perfect protection under any and all conditions of codling moth infestation.

The advisability and necessity of supplementing spraying with other measures of control, such as banding, picking off and destroying wormy apples during the season, and sanitation about packing houses, is readily apparent in those districts where experience has shown the codling moth normally to thrive in abundance. Likewise, it is evident that there is great need of discovering some method of control that may be used as a substitute for spraying with lead arsenate. There is reason for believing that advancements in this direction will be forthcoming as a result of research now under way.

Profitable Poultry

By Ralston R. Hannas

When Should the Chicks Be Hatched?

WHEN should the chicks be hatched? Everybody does not want their chicks arriving on the same dates. Problems are different on individual farms, and dates that suit one farmer will not suit another. So no definite rules can be made or should be made which will apply to everyone.

Yet a little care in planning when these chicks are to arrive will help considerably to improve conditions all the way round. Proper planning on this point will not only have chicks arrive at a time that is convenient and will fit in with other work, but will also help to have these birds mature as pullets to lay at about the time desired, that is, when egg prices are good.

It is a good plan to have from one-third to one-fourth of the flock hatched early, that is, from January 15 to February 15. Birds hatched as late as the first week in March are considered early by many. Early hatched birds will start to lay in the summer and will be increasing in production as egg prices advance. This early hatching is usually considered for Leghorns.

The heavier breeds, such as the Plymouth Rocks, Rhode Island Reds, Wyandottes, etc., are best hatched during the month of March. This will bring them to maturity by about October. The bulk of the Leghorn flock should be hatched during the month of April. This will bring them to maturity in September or October. If conditions on individual farms are such that earlier chicks can be handled, it is better to hatch the bulk of the Leghorn flock about a month earlier, providing lights are installed in the laying house so production can be kept up in the fall and the slight molt that sometimes comes to March hatched Leghorns can thus be prevented. It is not wise to hatch them in March, however, unless lights can be used, for a molt is likely to occur, and any advantage of early laying from these birds is thus lost. Such a hatching schedule should be considered when ordering chicks or when planning to hatch.

Keeping the Pedigree

TRAPNESTING is of little value unless it is followed by pedigree breeding. Trapnesting selects the good birds that can be used as breeders, providing, of course, the birds that are selected have the necessary physical characteristics that entitle them to be held for this purpose. Pedigree breeding and hatching enable the progeny of these good birds to be identified and the best of them used intelligently to improve the flock because of the known records back of them.

Pedigree hatching has another angle: trapnesting indicates a bird's record as a producer; pedigree hatching indicates her record as a reproducer. The one is just as important as the other, for a bird may lay a large number of eggs but unless she can produce a good number of strong, healthy chicks that will repeat her record, she is not worth much in improving the flock.

Pedigree hatching is a lot of work. That's why pedigreeing is done with only a small portion of the flock, as a rule. On the eighteenth day of incubation, the eggs are separated, and all those from the same hen are put together in a small cheesecloth bag and the bag tied, or are put in special wire pedigree hatching baskets. Better results are usually obtained with the baskets.

When the chicks hatch, they are identified by toe-punching or by leg or wing banding with small aluminum bands. Thirty-two different combinations are possible with the punching method: 16 are possible by using an ordinary punch that makes a round hole and 16 more by slitting the small web with a pair of scissors. This permits pedigreeing from 32 different birds. The use of wing bands or leg bands permits of pedigreeing from any number.

One of the most important things in pedigreeing is the records. Accurate records must be kept; they are no good unless they are accurate. Another important thing is to get the chicks out of the hatching bags or baskets as soon as possible so there will be no injury to the chicks and so no pedigrees will be lost, for if chicks are allowed to stay in these containers too long, either the egg shells containing the hen numbers will be broken or the other identification marks may be lost.

A Brooding House Problem

FOR THOSE who are considering buying or building new brooder houses this spring and enlarging their accommodations for layers by building a new laying house in the summer or early fall, there is an opportunity to save some money the present season. It will be too late to do it for early brooding, but it will be possible for March brooding or April and May brooding, depending upon individual circumstances.

The plan is to decide at once how large a laying house is to be built and to use this house as a brooding house the coming season. For example, if a laying house 20 by 40 feet is to be built, this can be built now and divided into four brooding units each 10 by 20 feet. The house will, of course, be 20 feet deep, which is pretty deep for a brooding house, but this can be remedied by building small partitions one foot or one and one-half feet high of wall board or some such material half way across the house to break up the drafts. These can easily be removed when desired.

When the chicks are old enough so the sexes can be distinguished, the males can be removed, or they may be left there until they can qualify as broilers, then sold. The pullets can be left right in the laying house. This will also save extra moving. Brooder houses need not be built for this year, therefore, but must be for next year, as there will be no place to put the old stock. This plan will, however, save expending the money this season, which can be put into more chicks, or better chicks or pedigree males in the fall.

Maintain Body Weight

AN IMPORTANT consideration at this time of the year is the condition of flesh of both the layers and breeders. Many birds will start laying all right in the fall and give great promise, but through poor feeding will lose flesh, will molt and will stop laying. Birds that are thin, or in poor flesh, are run down and are an easy prey to colds, roup, canker, etc. Breeders that are in poor flesh are not likely to produce strong, healthy chicks.

A grain feeding of from 13 to 14 pounds per 100 birds per day is what Leghorns should get in addition to dry mash kept before them all the time, and the heavier breeds should be fed grain at the rate of 15 to 16 pounds per 100 birds per day. If the birds do not clean up this grain the way they should, or if the proper weight is not maintained in spite of this, a wet mash can be fed once a day, as much as will be cleaned up in about 15 minutes. A good mash for this purpose is one composed of equal parts of corn meal (yellow) and ground rolled oats moistened with milk until the mash is crumbly—not sloppy.